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01 AERONAUTICS (GENERAL)

N76-20062* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 67, FEBRUARY 1976
Feb. 1976 100 p
(NASA-SP-7037(67)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 341 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1976. Author

N76-20063*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
THE OUTLOOK FOR AERONAUTICS, 1980 - 2000 - STUDY REPORT
Mar. 1976 41 p
(Contract NAS5-20852)
(NASA-TM-X-72995) Avail: NTIS HC $4.00 CSCL 01B

Trends in civil and military aviation in the period 1980-2000 are examined in terms of the role that NASA should play in aeronautical research and development during this period. Factors considered include the pattern of industry and government relationships, the character of the aircraft to be developed, and the technology advances that will be required as well as demographic, economic, and social factors. Trends are expressed in terms of the most probable developments in civil air transportation and air defense and several characteristically different directions for future development are defined. The longer term opportunities created by developments in air transporation extending into the next century are also examined. Within this framework, a preferred NASA role and a preferred set of objectives are formulated for the research and technology which should be undertaken by NASA during the period 1976-1985. Author

N76-20064*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
THE OUTLOOK FOR AERONAUTICS, 1980 - 2000: APPENDIX B: STUDY GROUP REPORT ON AN INDUSTRY-UNIVERSITY-GOVERNMENT SURVEY
Mar. 1976 46 p
(Contract NAS5-20852)
(NASA-TM-X-72996) Avail: NTIS HC $4.00 CSCL 01B

Results of a comprehensive survey of key representatives of the aeronautical community are presented. Emphasis is placed on trends in civil and military aviation, the role of NASA in aeronautical research and development, and the required technology advances for the development of new aircraft. J.M.S.

N76-20065*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
DOMESTIC AND WORLD TRENDS AFFECTING THE FUTURE OF AVIATION (1980 - 2000), APPENDIX C
Mar. 1976 78 p
(Contract NAS5-20852)
(NASA-TM-X-72997) Avail: NTIS HC $5.00 CSCL 01B

The results are presented of a study of variables affecting aviation in the United States during the last fifth of the twentieth century. A series of key trends relating to economic, social, political, technological, ecological, and environmental developments are identified and discussed with relation to their possible effects on aviation. From this analysis a series of scenarios is developed representing an array of possibilities ranging from severe economic depression and high international tension on the one hand to a world of detente which enjoys an unprecedented economic growth rate and relaxation of tensions on the other. A scenario is presented which represents the manner in which events will most probably develop and their effect on the aviation industry. Author

N76-20066*# Hudson Inst., Inc., Croton-on-Hudson, N.Y.
THE OUTLOOK FOR AERONAUTICS, 1980 - 2000: EXECUTIVE SUMMARY
Mar. 1976 18 p
(Contract NAS5-20852)
(NASA-TM-X-72998) Avail: NTIS HC $3.50 CSCL 01B

For abstract, see N76-20063.

N76-20067# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD HIGHLIGHTS, MARCH 1976
1 Mar. 1976 33 p
(AGARD-Highlights-76/1) Avail: NTIS HC $4.00

Reports of AGARD activities are presented. The articles presented concern: hurricane Eloise, Von Karman medals for 1975, air traffic control, aircraft fire safety, and personnel changes. F.O.S.

N76-20068# Federal Aviation Administration, Washington, D.C. Aviation Forecast Branch.
MILITARY AVIATION FORECASTS, FISCAL YEARS 1976 - 1987
Sep. 1975 38 p refs
(AD-A017622; FAA-AVP-75-12) Avail: NTIS HC $4.00 CSCL 01/2

Forecasts of military air traffic activity at facilities operated by the Federal Aviation Administration for the fiscal years 1976 through 1987 are presented. Data are given for all branches of the military and cover flight for the continental United States. Author

N76-20069# Federal Aviation Administration, Washington, D.C. Aviation Forecast Branch.
AVIATION FORECAST, FISCAL YEARS 1976 - 1987
Sep. 1975 76 p
(AD-A017095; FAA-AVP-75-7) Avail: NTIS HC $5.00 CSCL 01/2

The latest Federal Aviation Administration forecast of measures of workload and activity at towered airports, air route traffic control centers, and flight service stations for Fiscal Years 1976 to 1987 are given. The forecasts were made for the four major users of the system; air carriers, air taxi, general aviation and the military. The impact is reflected on aviation activity of a more rapid rate of price increase, especially for fuel, and a slower rate of real income growth than had been assumed in previous forecasts. Author

N76-20070# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
HISTORY OF MESSERSCHMITT AIRCRAFT MANUFACTURING
Johann Baptist Kaiser 29 Oct. 1975 43 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-75-21) Avail: NTIS HC $4.00; DFVLR, Cologne DM 22.20

The career of Willy Messerschmitt and the history of his firm is presented. Messerschmitt, constructor and research worker, aircraft builder and industrialist, is one of the last living pioneers from the start of the development of aeronautical technology at the beginning of this century. His contribution to this development is described. ESA

N76-20071# Federal Aviation Administration, Washington, D.C. Office of Management Systems.
THE 1974 US CIVIL AIRMEN STATISTICS Annual Study
May 1975 36 p
(AD-A013434) Avail: NTIS CSCL 05/9

The 1974 U.S. Civil Airmen Statistics is the sixth edition of an annual study published to meet the demands of FAA, other government agencies, and industry for more detailed airmen statistics than those published in other FAA reports. Statistics pertaining to airmen, both pilot and nonpilot, were obtained from the official airman certification records maintained by the Flight Services Technical Division, FAA Aeronautical Center, Oklahoma City, Oklahoma. GRA

N76-20072# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy.
THE GENERAL AVIATION INDUSTRY; AN OVERVIEW Staff Study Report
Thomas F. Henry and Maryann Froehlich Jul. 1975 66 p refs
(AD-A015871; FAA-AVP-75-4) Avail: NTIS CSCL 01/3

This report presents background information and statistics on various aspects of the general aviation (G.A.) industry. The report documents the impressive growth of the general aviation fleet, particularly since the 1960's, and illustrates recent trends in G.A. aircraft types and user categories. It emphasizes that G.A. activities are becoming increasingly important in the National Aviation System of Airports and Airways and that this implies increased FAA workload. The report also discusses trends in aircraft production and export and the relative market shares of the producers of G.A. aircraft, as well as the industry's overall contribution to the U.S. balance of payments. The discussion of energy considerations suggests that the Arab oil embargo and subsequent increases in oil prices brought on by the pricing policies of the Organization of Petroleum Exporting Countries (OPEC) had minimal effects on G.A. activities. However, legislative proposals designed to impose substantial taxes on gasoline production or sale might have depressing effects on future G.A. activities. Author (GRA)

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-20073 California Inst. of Tech., Pasadena.
EXPERIMENTS ON THIN AIRFOILS SPANNING A TRANSONIC SHEAR FLOW Ph.D. Thesis
Raymond Robert Cosner 1976 346 p
Avail: Univ. Microfilms Order No. 76-6525

A wind tunnel was built at the California Institute of Technology to provide two uniform coflowing streams at Mach numbers of 0.6 and 1.4 with a plane mixing layer in between. Preliminary studies were made of this free shear layer, indicating a region of self-similar behavior and general agreement in growth rate with previous studies. A program of experimental and theoretical work was completed in which wedges were installed in the supersonic stream to create shock waves incident on the shear layer. Similar studies were performed with wedges in the subsonic stream. Good agreement was found between the analytic first-order theory and experiment in showing that the upstream propagation of pressure disturbances ahead of their source in the uniform subsonic stream is limited to about 0.6 subsonic layer thicknesses. Dissert. Abstr.

N76-20074*# Polytechnic Inst. of New York, Farmingdale.
EXTENDED CONFORMAL MAPPINGS FOR SUPERSONIC AIRCRAFT CALCULATIONS Semiannual Progress Report, Oct. 1975 - Mar. 1976
Gino Moretti Mar. 1976 29 p refs
(Grant NsG-1248)
(NASA-CR-146541) Avail: NTIS HC $4.00 CSCL 01A

A gasdynamical analysis is presented for a three-dimensional, supersonic, inviscid, steady, shockless flow past an arbitrary airframe, using computational grids. The analysis, which includes special treatments for body points and bow-shock points, relies on the equations of motion written in terms of logarithm of pressure entropy and two angles reprising the velocity vector. A FORTRAN code was employed (sample geometry is shown). The flow analysis is considered reliable for aircraft cross-sections that are elliptical in shape. Author

N76-20075*# Kanner (Leo) Associates, Redwood City, Calif.
NUMERICAL INVESTIGATION OF FLOWS OF A REAL GAS PAST FINITE BODIES AND IN THEIR WAKES
Z. M. Yemelyanova Washington NASA Apr. 1976 51 p Transl. into ENGLISH from Vychislitelnyye Metody i Programmirovaniye (USSR), no. 23, 1974 p 3-41
(Contract NASw-2790)
(NASA-TT-F-16959) Avail: NTIS HC $4.50 CSCL 01A

Numerical methods are applied to a theoretical study of the structure of supersonic real gas flows past blunted bodies. A mathematical formulation of the problem is obtained. The problem is solved numerically, using a finite difference approximation of the initial equations, and solving the resulting systems of algebraic equations on difference nets covering the range of integration. The results obtained are analyzed. Author

N76-20076*# Princeton Univ., N.J.
[ILLIAC 4 AND LIFTING SURFACE THEORY WITH BOUNDARY LAYER] Semiannual Progress Report, 1 Oct. 1975 - 1 Apr. 1976
Earl H. Dowell 1 Apr. 1976 21 p refs
(Grant NGR-31-001-197)
(NASA-CR-146660) Avail: NTIS HC $3.50 CSCL 01A

Aerodynamic flutter and a re-written computer program for its study are discussed. Data cover: (1) lifting surface theory with boundary layer, (2) incompressible, two dimensional, unsteady flow with control surfaces, (3) improved unsteady theory, (4) combined transonic airfoil thickness and shear layer thickness effects, and (5) bending-torsion flutter calculations. E.H.W.

N76-20077*# Boston Univ., Mass.
FULLY UNSTEADY SUBSONIC AND SUPERSONIC POTENTIAL AERODYNAMICS FOR COMPLEX AIRCRAFT CONFIGURATIONS FOR FLUTTER APPLICATIONS
Kadin Tseng and Luigi Morino [1975] 14 p refs Presented at AIAA/ASME/SAE 17th Structures, Structural Dynamics and Materials Conf.
(Contract NGR-22-004-030)
(NASA-CR-146573) Avail: NTIS HC $3.50 CSCL 01A

A general theory for study, oscillatory or fully unsteady potential compressible aerodynamics around complex configurations is presented. Using the finite-element method to discretize the space problem, one obtains a set of differential-delay equations in time relating the potential to its normal derivative which is expressed in terms of the generalized coordinates of the structure. For oscillatory flow, the motion consists of sinusoidal oscillations around a steady, subsonic or supersonic flow. For fully unsteady flow, the motion is assumed to consist of constant subsonic or supersonic speed for time $t < \text{or} = 0$ and of small perturbations around the steady state for time $t > 0$. Author

N76-20078*# Scientific Translation Service, Santa Barbara, Calif.
AIRCRAFT USE IN AGRICULTURE AND FORESTRY
V. A. Nazarov Washington Feb. 1976 420 p Transl. into

ENGLISH of the book "Primeneniye Aviatsii v Selskom - Lesnom Khozyaystve" Moscow, Transport, 1975 p 1-311
(Contract NASw-2791)
(NASA-TT-F-16846) Avail: NTIS HC $11.00 CSCL 01C

Information is presented (a textbook) on the use of aircraft in agriculture and forestry, agricultural equipment for airplanes and helicopters, and the technology for performing, organizing, and standardizing aircraft application operations. All forms of aerial agricultural chemical application operations are covered in detail with consideration for the latest data: (1) combatting plant pests and diseases, (2) weed suppression, (3) mineral fertilizer application, (4) crop defoliation, (5) dessication and so on. The latest experience in crew operational procedures and the latest scientific advances are examined. Photographs are included.
Author

N76-20079*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EXPERIMENTAL AERODYNAMIC CHARACTERISTICS FOR SLENDER BODIES WITH THIN WINGS AND TAIL AT ANGLES OF ATTACK FROM 0 DEG TO 58 DEG AND MACH NUMBERS FROM 0.6 TO 2.0
Leland H. Jorgensen and Edgar R. Nelson Washington Mar. 1976 159 p refs
(NASA-TM-X-3310; A-6248) Avail: NTIS HC $6.75 CSCL 01A

An experimental investigation was conducted by wind tunnel to measure the static aerodynamic characteristics for bodies of circular and elliptic cross section with various thin flat plate wings and a thin tail consisting of horizontal and vertical parts. The wings had aspect ratios of 4 and taper ratios of about 0, 0.25, and 0.5. Two additional wings, which had taper ratios near 0.25 and aspect ratios of about 3 and 5, were also tested in combination with the bodies and tail. All wings had about the same planform area. The exposed area of the horizontal portion of the tail was about 33 to 36 percent of the exposed area of the wings. The exposed area of the vertical tail fin was about 22 to 24 percent of the exposed area of the wings. The elliptic body, with an a/b = 2 cross section, had the same length and axial distribution of cross sectional area as the circular body. The circular body had a cylindrical aftersection of fineness ratio 7, and it was tested with the wings and tail in combination with tangent ogive noses that had fineness ratios of 2.5, 3.0, 3.5, and 5.0. In addition, an ogive nose with a rounded tip and an ogive nose with two different nose strake arrangements were used. Nineteen configuration combinations were tested at Mach numbers of 0.6, 0.9, 1.5, and 2.0 at angles of attack from 0 to 58 deg. The Reynolds numbers, based on body base diameter, were about 4.3 X 100,000.
Author

N76-20080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY LAYER BLEED SYSTEM STUDY FOR A FULL-SCALE, MIXED-COMPRESSION INLET WITH 45 PERCENT INTERNAL CONTRACTION
Robert J. Shaw, Joseph F. Wasserbauer, and Harvey E. Neumann Washington Mar. 1976 72 p refs
(NASA-TM-X-3358; E-8494) Avail: NTIS HC $4.50 CSCL 01A

The results of an experimental bleed development study for a full-scale, Mach 2.5, axisymmetric, mixed-compression inlet were presented. The inlet was designed to satisfy the airflow requirements of the TF30-P-3 turbofan engine. Capabilities for porous bleed on the cowl surface and ram-scoop/flush-slot bleed on the centerbody were provided. A configuration with no bleed on the cowl achieved a minimum stable, diffuser exit, total pressure recovery of 0.894 with a centerbody-bleed mass flow ratio of 0.02. Configurations with cowl bleed had minimum stable recoveries as high as 0.900 but suffered range decrement penalties from the increased bleed mass flow removal. Limited inlet stability and unstart angle-of-attack data are presented. Author

N76-20081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTIONS ON A RECTANGULAR ASPECT-RATIO-6, SLOTTED SUPERCRITICAL AIRFOIL WING WITH EXTERNALLY BLOWN FLAPS
William G. Johnson, Jr. Washington Apr. 1976 254 p refs
(NASA-TM-X-3337; L-10558) Avail: NTIS HC $9.00 CSCL 01A

An investigation was made in the 5.18 m (17 ft) test section of the Langley 300 MPH 7 by 10 foot tunnel on a rectangular, aspect ratio 6 wing which had a slotted supercritical airfoil section and externally blown flaps. The 13 percent thick wing was fitted with two high lift flap systems: single slotted and double slotted. The designations single slotted and double slotted do not include the slot which exists near the trailing edge of the basic slotted supercritical airfoil. Tests were made over an angle of attack range of -6 deg to 20 deg and a thrust-coefficient range up to 1.94 for a free-stream dynamic pressure of 526.7 Pa (11.0 lb/sq ft). The results of the investigation are presented as curves and tabulations of the chordwise pressure distributions at the midsemispan station for the wing and each flap element.
Author

N76-20082*# Texas A&M Research Foundation, College Station.
TRANSONIC AIRFOIL DESIGN USING CARTESIAN COORDINATES Final Report
Leland A. Carlson Washington NASA Apr. 1976 35 p refs
(Grant NGR-44-001-157)
(NASA-CR-2578) Avail: NTIS HC $4.00 CSCL 01A

A numerical technique for designing transonic airfoils having a prescribed pressure distribution (the inverse problem) is presented. The method employs the basic features of Jameson's iterative solution for the full potential equation, except that inverse boundary conditions and Cartesian coordinates are used. The method is a direct-inverse approach that controls trailing-edge closure. Examples show the application of the method to design aft-cambered and other airfoils specifically for transonic flight.
Author

N76-20083# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Abteilung Angewandter Mathematik und Mechanik.
VISUALIZATION OF THE SUBSONIC FLOW AROUND TWO SPACE GLIDER CONFIGURATIONS
Hans Bippes and Pavle Colak-Antic 16 Jul. 1975 61 p refs In GERMAN; ENGLISH summary Original contains color illustrations Report will also be announced as translation
(DLR-FB-75-49) Avail: NTIS HC $4.50; DFVLR, Cologne DM 79,90

The subsonic flow around two delta wing space glider configurations with rounded leading edges and fuselage was made visible in a water towing basin by means of the hydrogen bubble technique for different angles of attack and yaw with Re-numbers ranging from 0.03 million to 1.2 million. Special attention was devoted to the observation of the development of the leading edge and body vortices and their interaction on the stabilizer flow, to leading edge vortex burst, and to flow separation and turbulence generation. The relevant three-dimensional flow phenomena were recorded by stereo photographs and are reproduced in print as anaglyphs (double-color pictures).
Author (ESA)

N76-20084# European Space Agency, Paris (France).
EXPERIMENTAL INVESTIGATION OF CONICAL CONVERGENT EJECTORS
Jean-Louis Solignac Nov. 1975 52 p refs Transl. into ENGLISH of 'Etude Exptl. des Ejecteurs Convergents Tronconiques', ONERA, Paris Report ONERA -NT-220, 1974
(ESA-TT-203; ONERA-NT-220) HC $4.50

The throat flow of conical ejectors was investigated by interferometry, using angles of convergence varying between 2 and 90 deg. The positions of the sonic line, the transonic boundary, and the following fundamental elements were defined: mass flow rate coefficient, critical expansion ratio, and axial velocity gradient at the sonic point. The initial data necessary for calculating supercritical flows downstream of the ejector throat are provided by a list defining the Mach angle characteristics reaching the axis at the point M = 1.2, or from a single curve obtained by correlation of these results.
Author (ESA)

N76-20085# European Space Agency, Paris (France).
CALCULATION AND DATA EVALUATION OF SUPERSONIC INLET FLOW OF TWO-DIMENSIONAL CASCADES

Peter Schimming Dec. 1975 28 p refs Transl. into ENGLISH of 'Berechnung u. exptl. Auswertung der Ueberschallanstroemung von zweidimensionalen Schaufelgittern', DFVLR, Porz, West Ger. Report DLR-FB-73-101, 22 Aug. 1973 Original German report available from DFVLR, Porz, West Ger. DM 11,70
(ESA-TT-209; DLR-FB-73-101) Avail: NTIS HC $4.00

A theoretical method for calculating the inflow properties of a supersonic cascade is presented and a similar method is described for ascertaining inlet Mach number and inlet flow direction in cascade measurements. Results of this data processing method are compared with an existing method. Author (ESA)

N76-20086# European Space Agency, Paris (France).
THE CALCULATION OF THE MEAN FLOW THROUGH ONE BLADE ROW OF AN AXIAL TURBOMACHINE
Jean-Pierre Veuillot Dec. 1975 60 p refs Transl. into ENGLISH of 'Calcul de l'Ecoulement Moyen dans une Roue de Turbomachine Axiale', ONERA, Paris Report ONERA-P-155, 1973
(ESA-TT-212; ONERA-P-155) Avail: NTIS HC $4.50

Two methods of calculating the mean flow are proposed, one analytical, after linearization of the flow equations, and the other purely numerical. Various results of the calculations are demonstrated. The following conditions are assumed: subsonic flow is of an ideal gas, uniform at infinity upstream; and the turbomachine is represented by two coaxial, infinitely long cylinders, its row of rotating blades or fixed vanes occupying a region contained between two cross-sections and consisting of a large number of blades or vanes (with or without thickness). The parameter epsilon (2pi/N) is assumed to be much less than 1 and it is supposed that the various characteristic flow parameters can be developed as a power series in epsilon; the mean flow is then defined as the fictitious flow described by the first terms of these series; this flow is shown to be axisymmetric.
Author (ESA)

N76-20087# European Space Agency, Paris (France).
A METHOD FOR THE CALCULATION OF THE TWIST AND CAMBER OF A WING WITH A SPECIFIED LOAD DISTRIBUTION IN THE PRESENCE OF A FUSELAGE
Horst Koerner Dec. 1975 76 p refs Transl. into ENGLISH of 'Ein Verfahren zur Berechnung der Verwindung u. Verwoelbung des Fluegels bei vorgegebener Lastverteilung unter Beruecksichtigung des Rumpfes', DFVLR, Brunswick Report DLR-FB-75-12, 1975 Original German report available from DFVLR, Porz, West Ger. DM 30.70
(ESA-TT-214; DLR-FB-75-12) Avail: NTIS HC $5.00

A theoretical potential flow method is described which can also be applied to wing-fuselage combinations, providing the fuselage is of circular cross-section or has approximately this form. The method is derived for incompressible flow but, by using the Goethert transformation, it may also be used for compressible subsonic flow. The theory, several sample calculations, the program, and its input requirements are described.
Author (ESA)

N76-20088# Naval Surface Weapons Center, White Oak, Md.
EXPERIMENTAL STUDY OF FORCES AND MOMENTS ON CIRCULAR BODIES AT HIGH ANGLE OF ATTACK
Andrew Wardlaw, Jr. Aug. 1975 30 p
(WF32322202)
(AD-A015644; NSWC/WOL-TR-75-66) Avail: NTIS CSCL 16/2

Twelve different slender bodies were tested at Mach 2 and 3 in the angle of attack range of 20 and 58 degrees. Normal and yaw forces and moments were monitored. On select models vortex paths were traced using schlieren pictures. Normal forces and moments were studied using the cross flow analogy. The accuracy of this analog appears to be best when the crossflow is supersonic. GRA

N76-20089# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE ROLE OF THE ZONE OF DEPENDENCE CONCEPT IN THREE-DIMENSIONAL BOUNDARY-LAYER CALCULATIONS Final Report
Clarence W. Kitchens, Jr., Raymond Sedney, and Nathan Gerber Aug. 1975 39 p refs
(DA Proj. 1T1-61102-A-14B)
(AD-A016896; BRL-1821) Avail: NTIS CSCL 20/4

The subject is studied for the general initial-value problem which arises in several applications; e.g., a spinning body at incidence. An exact solution which simulates the essential features of the boundary layer on such a body is used as a test case. The zone of dependence concept places a restriction on the local mesh aspect ratio that may be used. Results from four finite-difference schemes are compared against the exact solution for various wall speeds and mesh aspect ratios. Error growth occurs when the zone of dependence rule is not satisfied. The sensitivity and manner of error growth for the four schemes are different; two of them are relatively insensitive. From stability analyses it is shown that the concepts of stability and zone of dependence are not the same. Our numerical experiments partly contradict the stability analyses. GRA

N76-20090# ARO, Inc., Arnold Air Force Station, Tenn.
ABLATION AND VISCOUS EFFECTS ON THE FORCE AND MOMENT CHARACTERISTICS OF SLENDER CONE MODELS AT MACH 10 UNDER LAMINAR FLOW CONDITIONS
B. J. Griffith, W. T. Strike, and B. M. Majors AEDC Oct. 1975 38 p refs Sponsored by AEDC
(ARO Proj. V32A-25A)
(AD-A016396; ARO-VKF-TR-75-39; AEDC-TR-75-109) Avail: NTIS CSCL 20/4

A comprehensive wind tunnel investigation was conducted at Mach number 10 on 4- and 5-deg half-angle cones in order to study ablation and viscous effects under laminar flow conditions. Attention was focused on (1) the mode of ablation simulation, (2) obtaining consistent pitch plane force measurements in the angle-of-attack range from 0 to 4 deg, (3) the effect of bluntness, and (4) viscous effects over as large a Reynolds number range as possible. The subliming ablator used was camphor, which is compared to blowing through a porous surface using (1) nitrogen, (2) argon, and (3) sulphur hexafluoride (SF6) gases. GRA

N76-20091# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
AN ANALYSIS OF HEAT TRANSFER ON A JOUKOWSKI AIRFOIL WITH SEPARATION AND REATTACHMENT Interim Report, 1 Jan. 1973 - 1 Mar. 1975
Lucien Louis DeBruge Jul. 1975 121 p refs
(AF Proj. 3066)
(AD-A016457; AFAPL-TR-75-28) Avail: NTIS CSCL 20/4

The problem of separation bubbles in subsonic flow has been the object of much attention because of its incidence on the performance of turbomachinery and airfoils in general. An analytical method depicting a two-dimensional incompressible, steady-state flow over the convex side of a Joukowski airfoil on which a large separation bubble has developed is formulated. This method uses a potential flow configuration in cross flow and two equal but opposite vortices at rest behind the cylinder. The vortex strength generating the flow recirculation inside the bubble and the perturbation of the inviscid velocity distribution outside the separation bubble are so chosen that the calculated separation in cross flow occurs at a Reynolds number of 100,000. The average heat transfer coefficient obtained is compared with predicted values of flow separation over a cavity. GRA

N76-20092# Ballistic Research Labs., Aberdeen Proving Ground, Md.
APPLICATION OF MARQUARDT'S NONLINEAR LEAST SQUARES ALGORITHM TO FREE-FLIGHT YAW DATA ANALYSIS Final Memorandum Report
James W. Bradley Sep. 1975 56 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-A016906; BRL-MR-2526) Avail: NTIS CSCL 01/1

Marquardt's algorithm is an improved technique for the least squares estimation of nonlinear parameters. The present report describes the algorithm and documents a FORTRAN subroutine for carrying it out. A specific application of the subroutine is discussed in detail: fitting a complex yaw equation to data obtained from a Free Flight Range. An example is given in which the fitting process converged to the wrong answer without the algorithm and to the right answer with it. GRA

N76-20093# Army Aviation Systems Command, St. Louis, Mo.
AIRFOIL PROFILE DRAG Final Report
Milton A. Schwartzberg Jun. 1975 39 p refs
(DA Proj. 1F2-62209-AH-76)
(AD-A017321; USAAVSCOM-TR-75-19) Avail: NTIS CSCL 20/4

A method is presented for the estimation of the profile drag coefficient of airfoils at subsonic Mach numbers below the drag rise values. The method is applicable to smooth airfoils, with fully turbulent boundary layers, at any Reynolds number. The method is simple to apply for rapid estimation purposes, and to incorporate into an aircraft performance computation procedure. GRA

N76-20094# Flow Research, Inc., Kent, Wash.
ANALYSIS OF NOSETIP BOUNDARY LAYER TRANSITION MECHANISMS Final Report
Charles L. Merkle, Walter J. Grabowski, Toshi Kubota, and Denny R. S. Ko Jul. 1975 75 p refs
(Contract F44620-74-C-0049; AF Proj. 9781)
(AD-A017585; Flow-Res-60; AFOSR-75-1462TR) Avail: NTIS CSCL 20/4

Linear stability theory is being used to investigate the mechanisms which lead to boundary layer transition on re-entry vehicle nosetips. Specific efforts are aimed at determining the effects of various parameters including surface roughness, ablation, wall cooling, local Mach numbers, pressure gradient, and axisymmetric geometry on transition. Roughness is simulated by means of the 'turbulent sublayer' model which has been extended to compressible flow. Results indicate that both roughness and ablation strongly reduce the transition Reynolds number. A series of parametric stability solutions has been calculated for non-zero pressure gradient cases. Thus far, rough-wall solutions have been completed only near the stagnation point where the boundary layer is still stable to all disturbances. GRA

N76-20095# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
RESEARCH ON AEROELASTIC PHENOMENA IN AIRFOIL CASCADES SUPERSONIC UNSTEADY AERODYNAMIC PHENOMENA IN A CONTROLLED OSCILLATING CASCADE
Sanford Fleeter, Allen S. Novick, and Ronald E. Riffel Oct. 1975 78 p refs
(Contract N00014-72-C-0351; NR Proj. 094-369)
(AD-A017203; DDA-EDR-8617) Avail: NTIS CSCL 20/4

A unique supersonic inlet flow field unsteady cascade experiment is described wherein the time-dependent pressure distribution within a harmonically oscillating airfoil cascade is quantitatively determined. The torsional frequency of oscillation and the interblade phase angle are precisely controlled by means of on-line digital computers. The dynamic data obtained include the chordwise distribution of the unsteady pressure magnitude and its phase lag as referenced to the airfoil motion. Parameters varied include the cascade inlet Mach number, the interblade phase angle, the torsional axis location, and the reduced frequency. All of the data are correlated with state-of-the-art analytical predictions. Author (GRA)

N76-20096# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
UNSTEADY SURFACE FLOW BEHAVIOR ON A CASCADE OF AIRFOILS OSCILLATING BELOW STALL Technical Report, Mar. - Sep. 1975
Franklin O. Carta 29 Sep. 1975 76 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A017073; SQUID-TR-UTRC-1-PU; R75-912083-3) Avail: NTIS CSCL 20/4

Tests have been performed on a cascade of airfoils oscillating in pitch using hot films to detect unsteady changes in the flow over the suction surface. It was found that unsteady transition from laminar to turbulent flow propagates forward along the chord and that unsteady reattachment propagates rearward. At low incidence angle the turbulent flow region does not reach the leading edge, and at higher incidence angle the laminar flow region does not extend rearward beyond mid chord. Author (GRA)

N76-20097# National Center for Atmospheric Research, Boulder, Colo. Technology Div.
SCIENTIFIC BALLOONING HANDBOOK Final Report
Alvin L. Morris May 1975 475 p refs Sponsored by NSF
(PB-246575/5; NCAR-TN/IA-99) Avail: NTIS HC $12.00 CSCL 01C

The current state of scientific ballooning technology is summarized. Principles are emphasized throughout, but procedures for planning and operations are also included. Extensive tables and graphs provide essential data and computational aids, and equations are provided to enhance application of computer technology to ballooning problems. The theory of balloon flight, energy balance and a flight model, lift gases, balloon design considerations, instrumentation, superpressure balloons are included. GRA

N76-20098# Naval Intelligence Support Center, Washington, D.C. Translation Div.
THE GROUND EFFECT ON THE AERODYNAMIC CHARACTERISTICS OF AN AIRCRAFT
Ya. M. Serebriiskii 23 Oct. 1975 55 p refs Transl. into ENGLISH from Uch. Zap. Tsentr. Aerogidrodinamicheskii Inst. (USSR), v. 267, 1936 p 2-37
(AD-A017309; NISC-Trans-3700) Avail: NTIS CSCL 01/1

An analysis of aerodynamic characteristics in steady horizontal flight near the ground is presented. Wieselsberger's formula representing the wing by a vortex sheet is derived and a formula based on the Helmbold vortex system is proposed. A mirror-image experiment conducted in a TsAGI T-5 wind tunnel with a conventional model wing and a wing with TsAP flaps is described. Results indicate that experimental data agree with theoretical calculations from the formula based on a Helmbold vortex system for a conventional wing. A model of a phenomenon similar to a hydraulic collector system is proposed to explain the phenomena occuring in the wing with flaps. Results of longitudinal stability are also given. Other methods of investigating steady horizontal flight near the ground are briefly reviewed. Author

N76-20099# Naval Research Lab., Washington, D.C.
CHARACTERISTICS OF THE TETHER LINE FOR AIRBORNE VEHICLES AT SEA
Stuart G. Gathman 30 Sep. 1975 29 p refs
(AD-A017597; NRL-7919) Avail: NTIS CSCL 01/3

The interaction between an airborne tethered vehicle and its tethered line can be described by several techniques. A simple equation was developed which can predict the maximum height obtainable with a known lift and drag but neglecting the force of the wind on the tether line. Numerical and graphical solutions to the system of equations which describe the effects of gravity and wind on the tether line were also developed. Applications of these solutions include determining the height of the vehicle from surface measurements alone; determining the mean wind in the layer between the vehicle and the surface from surface measurements alone if the vehicle can be seen; determining the mean wind in the layer between the vehicle and the surface if the vehicle can not be seen but with the additional knowledge of the vehicle altitude; calculating the flight path of the tethered vehicle as it leaves the flight deck to minimize the probability of diving to the surface in the turbulent eddies downwind of the ship; and calculating the maximum altitude which can be obtained, taking into account the force of the wind on the tether line. GRA

N76-20100# Winzen Research, Inc., South St. Paul, Minn.
CRITERIA FOR CONTROLLING VERTICAL MOTION OF STRATOSPHERIC BALLOONS Final Report, 2 Aug. 1974 - 31 Aug. 1975
Jean R. Nelson 6 Nov. 1975 82 p refs
(Contract N00014-75-C-0072; NR Proj. 211-189)
(AD-A017552) Avail: NTIS CSCL 01/3

A successful scientific balloon flight mission is dependent upon accurate control of vertical motion. The scientist wants a rapid ascent to his altitude of interest, but this desire must be tempered by avoiding aerodynamic stress damage to the balloon. Reasonable limits on altitude variation caused by temperature fluctuation are desired, so effective management of ballast is required on zero pressure balloons. There are also special situations with multiple altitude requirements that require efficient

management of ballasting and valving for vertical motion control. Empirical equations were developed by the University of Minnesota (under contract to ONR and jointly sponsored by the U.S. Army, Navy and Air Force) before 1960. The night ascent technique frequently used now also poses a new environment regime so it was considered necessary to re-evaluate the vertical motion response using current computer capabilities. GRA

N76-21125 European Space Agency, Paris (France).
ON THE FLOW AROUND AN AIR INLET
Henri Werle and Marc Gallon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 39-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 81-92 (For availability see N76-21123 11-99)

N76-21130 Institut Franco-Allemand de Recherches, St. Louis (France).
GYROSCOPIC STABILITY FACTOR OF PROJECTILES WITH NONLINEAR MOMENTS
H. Molitz *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 9-27 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-20101*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A STUDY OF THE FINANCIAL HISTORY OF THE U.S. SCHEDULED AIRLINES AND THE IMPROVEMENT OF AIRLINE PROFITABILITY THROUGH TECHNOLOGY
Darrell E. Wilcox Jul. 1975 64 p refs
(NASA-TM-X-73109; A-6462) Avail: NTIS HC $4.50 CSCL 05C

The financial history of the U.S. scheduled airline industry was investigated to determine the causes of the erratic profit performance of the industry and to evaluate potential economic gains from technology advances of recent years. Operational and economic factors affecting past and future profitability of the industry are discussed, although no attempt was made to examine the profitability of individual carriers. The results of the study indicate that the profit erosion of the late 1960's and early 1970's was due more to excess capacity than to inadequate fare levels, but airline problems were severely compounded by the rapid fuel price escalation in 1974 and 1975. Near-term solutions to the airline financial problems depend upon the course of action by the industry and the CAB and the general economic health of the nation. For the longer term, the only acceptable alternative to continued fare increases is a reduction in unit operating costs through technological advance. The next generation of transports is expected to incorporate technologies developed under Government sponsorship in the 1960's and 1970's with significant improvements in fuel consumption and operating costs. Author

N76-20102*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Interim Report
G. A. McAlpine and J. H. Highfill Mar. 1976 37 p refs
(Grant NsG-1128)
(NASA-CR-146664; EE-4033-102-76) Avail: NTIS HC $4.00 CSCL 01E

The design of a microwave landing system (MLS) aircraft receiver, capable of optimal performance in multipath environments found in air terminal areas, is reported. Special attention was given to the angle tracking problem of the receiver and includes tracking system design considerations, study and application of locally optimum estimation involving multipath adaptive reception and then envelope processing, and microcomputer system design. Results show processing is competitive in this application with i-f signal processing performance-wise and is much more simple and cheaper. A summary of the signal model is given. Author

N76-20103# Control Data Corp., St. Paul, Minn.
RESULTS OF THE VISUAL DETECTION SIMULATION EXPERIMENT FOR THE EVALUATION OF AIRCRAFT PILOT WARNING INSTRUMENTS (APWI), VOLUME 2 Final Report
W. Graham and V. Mangulis Dec. 1974 230 p refs
(Contract DOT-FA70WA-2263)
(AD-A017023; FAA-RD-75-59-Vol-2) Avail: NTIS HC $8.00 CSCL 01/2

Evaluated are Aircraft Pilot Warning Instruments (APWI) in a Visual Detection Simulator (VDS) built specifically for this purpose. The simulator and the design and conduct of the experiment are described in detail. APWI systems with sharp range and altitude cut-offs were simulated with bearing resolutions of 180 deg, 30 deg, and 2 deg; part of the experiment was run with no APWI at all for comparison. The results show that the most critical factor in determining the probability of detection of a target is the time available to the pilot for detection; if the time is long enough the pilot will eventually see it, and if the time is too short even the best of APWI will not help him. There was significant variation found among all pilots in their ability to detect targets and extreme differences were found between the best and worst pilots in this respect. Author

N76-20104*# Douglas Aircraft Co., Inc., Santa Monica, Calif.
OPERATIONAL FACTORS OF AIR SERVICE TO SMALL COMMUNITIES Final Report
Dec. 1975 162 p refs
(Contract NAS2-8135)
(NASA-CR-137820) Avail: NTIS HC $6.75 CSCL 05A

The feasibility of using 30-passenger jet aircraft to service low density, short haul markets was analyzed. Aircraft characteristics, market potential, and economic factors were among the areas evaluated. D.M.L.

N76-20105# Federal Aviation Administration, Oklahoma City, Okla. Flight Standards Technical Div.
CONCEPTS IN SAFETY BELT TESTING Final Report
James W. Ross, Jr. Apr. 1975 41 p refs Presented at the Business Aircraft Meeting of the Soc. of Automotive Engr., Wichita, Kas., 8-11 Apr. 1975 Previously announced as SAE-750540 (AD-A011077; FAA-TR-FS-75-782-120A; SAE-750540) Avail: NTIS CSCL 01/2

The purpose of the paper is to present concepts for more representative testing of inertia reels and shoulder harness assemblies. These concepts were explored as part of a study to determine design and performance criteria appropriate for civil aircraft safety belts. GRA

N76-20106*# National Aeronautics and Space Administration, Washington, D.C.
GENERAL AVIATION TECHNOLOGY PROGRAM
Mar. 1976 20 p
(NASA-TM-X-73051; NASA-News-Release-76-51)
Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 01C

The research and technology program of the civil air transportation system is reported. Research is discussed for stall/spin, crashworthiness, pilot operations, flight efficiency, propulsion, and avionics. F.O.S.

N76-20107*# United Air Lines, Inc., Chicago, Ill.
FLIGHT EVALUATION OF TWO-SEGMENT APPROACHES USING AREA NAVIGATION GUIDANCE EQUIPMENT Final Report
G. K. Schwind, J. A. Morrison, W. E. Nylen, and E. B. Anderson Washington NASA Apr. 1976 52 p refs
(Contract NAS2-7475)
(NASA-CR-2679) Avail: NTIS HC $4.50 CSCL 17G

A two-segment noise abatement approach procedure for use on DC-8-61 aircraft in air carrier service was developed and

evaluated. The approach profile and procedures were developed in a flight simulator. Full guidance is provided throughout the approach by a Collins Radio Company three-demsional area navigation (RNAV) system which was modified to provide the two-segment approach capabilities. Modifications to the basic RNAV software included safety protection logic considered necessary for an operationally acceptable two-segment system. With an aircraft out of revenue service, the system was refined and extensively flight tested, and the profile and procedures were evaluated by representatives of the airlines, airframe manufacturers, the Air Line Pilots Association, and the Federal Aviation Administration. The system was determined to be safe and operationally acceptable. It was then placed into scheduled airline service for an evaluation during which 180 approaches were flown by 48 airline pilots. The approach was determined to be compatible with the airline operational environment, although operation of the RNAV system in the existing terminal area air traffic control environment was difficult. Author

N76-20108# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

STATISTICAL AND FLIGHT MECHANICAL STUDIES ON VISUAL CONFLICT DETECTION AND RESOLUTION IN CIVIL AVIATION

Otto Weber 3 Nov. 1975 122 p refs In GERMAN; ENGLISH summary

(DLR-FB-75-71) Avail: NTIS HC $5.50; DFVLR Cologne DM 44,10

Theoretical studies in the field of statistics and flight mechanics concerning conflict detection and resolution by the 'see and avoid' concept were made. American and German statistics on midair and near midair collisions are discussed. For flights without acceleration basic geometrical and physical aspects of conflict detection are derived and details on the angles of vision from the pilot to the other aircraft and on 'dead zones' are given. Horizontal evasive maneuvers are analyzed in detail and their effectiveness is presented in graphs which can be used for numerous tasks. Two observation error models are described and the influences on the distances where horizontal evasive maneuvers are possible are estimated. Vertical maneuvers are treated concisely and some tentative suggestions for the improvement of flight safety are made. Author (ESA)

N76-20109# General Electric Co., Schenectady, N.Y.

COMPUTER PROGRAMS FOR PREDICTION OF LIGHTNING INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL CIRCUITS, VOLUME 1 Final Report, 1 Feb. - 30 Nov. 1974

K. J. Maxwell, F. A. Fisher, J. A. Plumer, and P. R. Rogers Apr. 1975 161 p refs

(Contract F33615-74-C-3068; AF Proj. 680J)

(AD-A015174; SRD-75-005-Vol-1; AFFDL-TR-75-36-Vol-1) Avail: NTIS CSCL 01/3

The report describes a computerized program to define the induced circuit voltage within an aircraft electrical system due to a lightning strike on the aircraft. One routine of the program DIFFUSION calculates the effect of magnetic fields caused by current on the aircraft skin. The other routine APERTURE calculates the magnetic field that enters the aircraft because of an opening. The induced voltages are then calculated for any given electrical circuit. The program has defined geometrical configurations for a fuselage, rectangular wing, and empennage sections. A subroutine calculates the current distribution on the skin of the section being analyzed. The program input current and output voltage are in the time domain. GRA

N76-20110# General Electric Co., Schenectady, N.Y.

OPERATOR'S MANUAL FOR COMPUTER PROGRAMS FOR PREDICTION OF LIGHTNING INDUCED VOLTAGES IN AIRCRAFT ELECTRICAL CIRCUITS, VOLUME 2 Final Report, 1 Feb. - 30 Nov. 1974

K. J. Maxwell, F. A. Fisher, J. A. Plumer, and P. R. Rogers Apr. 1975 44 p refs

(Contract F33615-74-C-3068; AF Proj. 1987)

(AD-A014835; SRD-75-006-Vol-2; AFFDL-TR-75-36-Vol-2) Avail: NTIS CSCL 01/3

The manual describes the use of computer programs defined in the technical report 'Computer Programs for Prediction of Lightning Induced Voltages in Aircraft Electrical Circuits'. It supplements the technical report with information on the use of the computer programs. GRA

N76-20111# Naval Postgraduate School, Monterey, Calif.

ANALYSIS OF THE VARIABLE BEHAVIOR MANIFESTED IN ALL NAVY/MARINE MAJOR AIRCRAFT ACCIDENT RATES M.S. Thesis

John Scott Maxwell and Laurence Valdimir Stucki Sep. 1975 56 p refs

(AD-A016380) Avail: NTIS CSCL 01/2

All Navy/Marine monthly aircraft accident rates exhibit a behavior of marked variability which cannot be attributed solely to weather or other natural phenomena. Variable measures construed as time dependent were obtained for all major accidents between July 1968 and June 1974. Stepwise linear multiple regression studies relate the variables to accident rates, involving pilot age, daylight pilot flight hours for the 90 days preceding the accident, the number of night carrier landings in the previous 30 days, and the number of daylight carrier landings in the previous 30 days. GRA

N76-20112# AeroVironment, Inc., Pasadena, Calif.

INVESTIGATION OF VORTEX WAKE STABILITY NEAR THE GROUND Final Report, 1 Feb. 1974 - 31 Mar. 1975

I. H. Tombach, S. C. Crow, and E. R. Bate, Jr. 31 Jul. 1975 75 p refs

(Contract F44620-74-C-0058; AF Proj. 9781)

(AD-A017586; AV-FR-538; AFOSR-75-1501TR) Avail: NTIS CSCL 20/4

Vortex wakes exist in a complicated environment near the ground at airports. Under many situations, factors combine to move a wake sufficiently far from the runway approach corridor that it does not constitute a hazard to following aircraft. Situations exist, however, where a wake can possibly linger at high strength long enough to present operational problems. The sinuous mutual induction instability of a vortex pair has been investigated theoretically and experimentally in atmospheric conditions which prevail near the ground, thereby extending previous work of Crow and Bate for the same instability aloft. Two theoretical models were developed -- one for a vortex pair in the constant stress layer of the atmospheric boundary layer, and the second for a vortex interacting with its image when in ground effect. GRA

N76-20113# Federal Aviation Administration, Washington, D.C. Information and Statistics Div.

COMMUTER AIR CARRIER OPERATORS AS OF SEPTEMBER 1974

Apr. 1975 61 p

(AD-A014041) Avail: NTIS CSCL 01/2

The Civil Aeronautics Board (CAB) in 1969, issued amendments to the Economic Regulations for air taxi operators. One of these required all air taxi operators to register before July 1, 1969, and annually thereafter. Commuter air carriers as defined by CAB are operators who perform, pursuant to published schedules, at least five round trips per week between two or more points, or carry mail. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N76-20114* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MAGNETIC HEADING REFERENCE Patent

Howell D. Garner, inventor (to NASA) Issued 16 Mar. 1976 12 p Filed 11 Dec. 1974 Supersedes N75-12947 (13 - 04, p 0382)

(NASA-Case-LAR-11387-1; US-Patent-3,943,763; US-Patent-Appl-SN-531647; US-Patent-Class-75-178R; US-Patent-Class-33-356) Avail: US Patent Office CSCL 17G

A magnetometer is used as a magnetic heading reference for a vehicle such as a small aircraft. The magnetometer is mounted on a directional dial in the aircraft in the vicinity of the pilot such that it is free to turn with the dial about the yaw axis of the aircraft. A circuit is included for generating a signal proportional to the northerly turning error produced in the magnetometer due to the vertical component of the earth's magnetic field. This generated signal is then subtracted from the output of the magnetometer to compensate for the northerly turning error. Official Gazette of the U.S. Patent Office

N76-20115*# Ohio Univ., Athens. Avionics Engineering Center.

DIGITAL CORRELATION DETECTOR FOR LOW-COST OMEGA NAVIGATION

Kent A. Chamberlin Feb. 1976 55 p refs

(Grant NGR-36-009-017)

(NASA-CR-144956; OU-TM-19) Avail: NTIS HC $4.50 CSCL 17G

Techniques to lower the cost of using the Omega global navigation network with phase-locked loops (PLL) were developed. The technique that was accepted as being 'optimal' is called the memory-aided phase-locked loop (MAPLL) since it allows operation on all eight Omega time slots with one PLL through the implementation of a random access memory. The receiver front-end and the signals that it transmits to the PLL were first described. A brief statistical analysis of these signals was then made to allow a rough comparison between the front-end presented in this work and a commercially available front-end to be made. The hardware and theory of application of the MAPLL were described, ending with an analysis of data taken with the MAPLL. Some conclusions and recommendations were also given. Author

N76-20116# Michigan Univ., Ann Arbor. Dept. of Electrical and Computer Engineering.

SIDELOBE SUPPRESSION MODE PERFORMANCE OF ATCRBS WITH VARIOUS ANTENNAS Interim Report, Jul. 1973 - Jun. 1974

Jovan Zatkalik, Dipak L. Sengupta, and Chen-To Tai Feb. 1975 161 p refs

(Contract DOT-TSC-717)

(AD-A015242; DOT-TSC-FAA-75-3; FAA-RD-75-31) Avail: NTIS HC $6.25 CSCL 17/7

The SLS mode performance of terminal and enroute ATCRBS using existing and various improved antennas in the presence of perfectly dielectric flat ground was investigated theoretically. Necessary analytical expressions for various quantities characterizing the system performance have been derived. A computer program has been developed for the computation and tabulation of these quantities as function of the elevation angle of the observation point for different combinations of heights of the directional and omnidirectional antennas. For each antenna combination results are given for the following seven quantities: the P1 and P2 pulse intensities, the pulse ratio P1/P2, the mainbeam killing and sidelobe punch-through zones in space, the effective azimuth beamwidth, the number of replies and the coverage diagram. Author

N76-20117# Transportation Systems Center, Cambridge, Mass.

POSITION MEASUREMENT STANDARD EVALUATION Final Report, Jan. - Aug. 1974

John Canniff, Richard Gunderson, and John Gakis Feb. 1975 58 p

(AD-A017012; DOT-TSC-FAA-75-17; FAA-RD-75-26) Avail: NTIS HC $4.50 CSCL 17/7

The objectives of the position measurement standard program were to collect navigation data from three distance measuring equipment (DME) receivers and a low-frequency global navigation system, and evaluate their relative performance against a reference radar. Flight test data during June and July, 1974, established that: triple DME was an order of magnitude more accurate than the global system; triple DME accuracy was repeatable smooth over all flight regions, and insensitive to initial condition, whereas global system accuracy varied from run to run, exhibited large random errors and quantum jumps, and was dependent upon error nulling procedures prior to system initialization. Author

N76-20118# National Aviation Facilities Experimental Center, Atlantic City, N.J.

THE CONTROLLER/COMPUTER INTERFACE WITH AN AIR-GROUND DATA LINK, VOLUME 2 Final Report

S. Rossiter, R. Wiseman (Transportation Systems Center, Cambridge, Mass.), M. Connelly (MIT, Cambridge, Mass.), and T. Morgan (Computer Sciences Corp., Arlington, Va.) Sep. 1975 250 p refs

(AD-A017369; FAA-NA-74-21-Vol-2) Avail: NTIS HC $8.00 CSCL 17/7

A dynamic simulation study was conducted to determine the display techniques and operating procedures that best enable an air traffic controller to work in a mixed voice/digital communications environment. The benefits that might accrue to ground-based automatic control through further automation of the controller's communication tasks are examined. A simplified version of the ARTS III Metering and Spacing system was used to assess the controller's communication task when automatically generated control commands were transmitted to voice link or to data link-equipped aircraft in terminal approach traffic. Subject to follow-on testing of a more operational nature, it was concluded that a data link channel efficiently augments the voice channel, the value increasing as the percentage of data link aircraft increases. Results show that further efficiencies can be obtained through the use of computer-generated speech, one-at-a-time display of commands moving with the aircraft target symbol, and by the automatic transmission of commands on both the voice and data link channels. The automatic command transmission eliminates the controller's tasks of approving commands, placing more emphasis on traffic situation monitoring. Author

N76-20119# CNR, Inc., Newton Upper Falls, Mass.

IMPACT OF SATELLITE AERONAUTICAL CHANNEL ON MODEM SPECIFICATIONS. PHASE 2: OCEANIC MULTIPATH MEASUREMENTS AND MODEM CONCEPTS Final Report, Mar. 1973 - Mar. 1974

Phillip A. Bello, David Chase, Joseph DeRosa, Lih-Jyh Weng, and Martin G. Bello Jan. 1975 195 p refs

(Contract DOT-TSC-516-2)

(AD-A005788; DOT-TSC-FAA-74-27; FAA-RD-74-215) Avail: NTIS HC $7.00 CSCL 17/7

The analysis previously initiated on the effects of oceanic multipath on ranging and data modems for satellite air traffic control system was completed. The interaction between multipath antenna and apparent measured multipath is determined using a 'Vector Kirchoff' model of ocean scattering. Procedures for antenna design, sea state sensing, and multipath measurements are detailed, and tone ranging performance is computed for various antenna designs. Consideration is given to the problem of tone probing on a 50 KHz hard limiting AEROSAT channel while data transmission is taking place. The problem of how much measurement time is needed to achieve a reliable channel of error probability in data transmission over the AEROSAT channel is addressed. It is also shown that with the proper integration of coding and modulation techniques, it is possible to construct a robust signaling scheme which is insensitive to the multipath and which can improve performance when operating in the region of low direct path signal-to-noise ratios. Author

N76-20120# Naval Postgraduate School, Monterey, Calif.

INVESTIGATION OF VARIOUS NAVIGATION SYSTEMS THAT WOULD BE COMPATIBLE TO THE TASES AIRCRAFT M.S. Thesis

Charles Leroy Jeffries Sep. 1975 89 p refs

(AD-A016377) Avail: NTIS CSCL 17/7

TASES (Tactical Airborne Signal Exploitation System) will modify the basic S-3A avionics system to perform an open ocean fleet support electronic mission. Navigation of the aircraft will be performed by the pilot using systems that were designed for an ASW mission and dual piloted aircraft. The addition of an automatic Omega tracking receiver would ease the burden of navigation in the event of primary system failure. The pilot/navigator would be provided a reliable and accurate world-wide fixing device that would augment the basic navigation system. A relative fixing scheme could also be incorporated, using the

Omega system that would provide accurate ranges and bearings of reported targets at distances exceeding 250 nautical miles.
GRA

N76-20121# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
SRDS TECHNICAL PROGRAM DOCUMENT, FISCAL YEAR 1976 ENGINEERING AND DEVELOPMENT APPROVED PROGRAMS Annual Technical Program
Jul. 1975 152 p
(AD-A011088) Avail: NTIS CSCL 17/7

The technical program document (TPD) contains research and technology resumes which reflect Systems Research and Development Service, Federal Aviation Administration, approved subprograms. These resumes identify the technical objective, approach, milestones scheduled for accomplishment, accomplishments, requirements, etc. GRA

N76-20122# Federal Aviation Administration, Washington, D.C. Aviation Forecast Branch.
PROFILES OF SCHEDULED AIR CARRIER OPERATIONS BY STATE LENGTH. FEDERAL AVIATION ADMINISTRATION REGIONS TOP 100 US AIRPORTS, 1 NOVEMBER 1974
May 1975 344 p
(AD-A016161) Avail: NTIS CSCL 01/2

The first section of this report provides data on total scheduled air carrier aircraft operations by trip length by hour of the day for Friday, November 1, 1974, for the top 100 airports within the 50 states of the United States and the District of Columbia. The second section of the report shows the same information for each of the 11 Federal Aviation Administration regions. The FAA regional information is for those airports in the region that are included in the top 100 airports. GRA

N76-20123# Naval Electronics Lab. Center, San Diego, Calif.
VLF NAVIGATION MONITOR: ENGINEERING DESIGN Final Report, Dec. 1973 - May 1975
E. R. Swanson and J. E. Britt 28 Jun. 1975 30 p refs
(Contract DOT-FA74WAI-425)
(AD-A015904; NELC-TR-1959; FAA-RD-75-148) Avail: NTIS CSCL 17/7

Engineering architecture of a monitor to warn of VLF signal anomalies is described. Purpose and function of the monitor are described in a companion report (DOT FA74WAI-425-4). This report describes the basic engineering approach to the monitor design and construction including both hardware and software.
GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-20124*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ENERGY AND ECONOMIC TRADE OFFS FOR ADVANCED TECHNOLOGY SUBSONIC AIRCRAFT
Dal V. Maddalon and Richard D. Wagner 1 Apr. 1976 25 p refs
(NASA-TM-X-72833) Avail: NTIS HC $3.50 CSCL 01C

Changes in future aircraft technology which conserve energy are studied, along with the effect of these changes on economic performance. Among the new technologies considered are laminar-flow control, composite materials with and without laminar-flow control, and advanced airfoils. Aircraft design features studied include high-aspect-ratio wings, thickness ratio, and range. Engine technology is held constant at the JT9D level. It is concluded that wing aspect ratios of future aircraft are likely to significantly increase as a result of new technology and the push of higher fuel prices. Composite materials may raise aspect radio to about 11 to 12 and practical laminar flow-control systems may further increase aspect ratio to 14 or more. Advanced technology provides significant reductions in aircraft take-off gross weight, energy consumption, and direct operating cost. Author

N76-20125*# Sikorsky Aircraft, Stratford, Conn.
RSRA SIXTH SCALE WIND TUNNEL TEST. TABULATED BALANCE DATA, VOLUME 2 Final Report, Mar. - Nov. 1974
A. Ruddell and R. Flemming 4 Dec. 1974 1099 p
(Contract NAS1-13000)
(NASA-CR-144965; SER-72011-Vol-2) Avail: NTIS HC $28.25 CSCL 01C

Summaries are presented of all the force and moment data acquired during the RSRA Sixth Scale Wind Tunnel Test. These data include and supplement the data presented in curve form in previous reports. Each summary includes the model configuration, wing and empennage incidences and deflections, and recorded balance data. The first group of data in each summary presents the force and moment data in full scale parametric form, the dynamic pressure and velocity in the test section, and the powered nacelle fan speed. The second and third groups of data are the balance data in nondimensional coefficient form. The wind axis coefficient data corresponds to the parametric data divided by the wing area for forces and divided by the product of the wing area and wing span or mean aerodynamic chord for moments. The stability axis data resolves the wind axis data with respect to the angle of yaw. Author

N76-20126*# Sikorsky Aircraft, Stratford, Conn.
RSRA SIXTH SCALE WIND TUNNEL TEST Final Report, Mar. - Nov. 1974
R. Flemming and A. Ruddell 4 Dec. 1974 690 p refs
(Contract NAS1-13000)
(NASA-CR-144964; SER-72011) Avail: NTIS HC$16.25 CSCL 01A

The sixth scale model of the Sikorsky/NASA/Army rotor systems research aircraft was tested in an 18-foot section of a large subsonic wind tunnel for the purpose of obtaining basic data in the areas of performance, stability, and body surface loads. The model was mounted in the tunnel on the struts arranged in tandem. Basic testing was limited to forward flight with angles of yaw from -20 to +20 degrees and angles of attack from -20 to +25 degrees. Tunnel test speeds were varied up to 172 knots (q = 96 psf). Test data were monitored through a high speed static data acquisition system, linked to a PDP-6 computer. This system provided immediate records of angle of attack, angle of yaw, six component force and moment data, and static and total pressure information. The wind tunnel model was constructed of aluminum structural members with aluminum, fiberglass, and wood skins. Tabulated force and moment data, flow visualization photographs, tabulated surface pressure data are presented for the basic helicopter and compound configurations. Limited discussions of the results of the test are included. Author

N76-20127# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Entwurfsaerodynamik.
THREE COMPONENT MEASUREMENTS ON A LIGHT STOL AIRCRAFT WITH CHORDWISE BLOWING
Horst Koerner and Reinhard Loehr (A. Piller KG, Osterode, West Ger.) 7 Nov. 1975 23 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-74) Avail: NTIS HC $3.50; DFVLR, Cologne DM 10.20

Investigations on a STOL-airplane with internally blown flaps are described. To avoid flow separation on the wing, slots were located behind the nose flap and in front of the trailing edge flap. Maximum lift and optimum L/D were investigated, as well as the effectiveness of the aileron and the horizontal tail.
Author (ESA)

N76-20128# European Space Agency, Paris (France).
THE DESIGN OF UNSWEPT LARGE ASPECT RATIO WINGS WITH FLAPS FOR TWO FLIGHT CONDITIONS
Guenter Redeker Dec. 1975 37 p refs Transl. into ENGLISH of 'Auslegung von ungepfeilten Tragfluegeln grossen Seitenverhaeltnisses mit Woelbklappen fuer zwei Entwurfspunkte', DFVLR, Brunswick Report DLR-FB-75-34, 10 Apr. 1975 Original German

report available from DFVLR, Cologne DM 14,80
(ESA-TT-224; DLR-FB-75-34) Avail: NTIS HC $4.00

The method described is carried out by using flaps, covering the whole span, which have to be deflected in such a way as to obtain a minimum drag. Calculations are done quickly with a computer program for the line lifting theory which incorporates the influence of flaps. The method is explained with the help of an example of an existing sailplane. Author (ESA)

N76-20129# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.

INVESTIGATION OF ACCELERATED LIFE PREDICTION TECHNIQUES Final Report, 1 Mar. 1974 - 28 Feb. 1975

Jack A. Collins and Ben Tarver Hagan, Jr. Oct. 1975 61 p refs
(Contract DAAJ02-74-C-0033; DA Proj. 1F2-62203-AH-86)
(AD-A016925; USAAMRDL-TR-75-38) Avail: NTIS CSCL 01/3

The objectives of the work reported were to define potentially useful failure prediction models for the wear and fretting-wear modes of failure, to define the parameters of primary importance, to incorporate the concept of accelerated testing both in the prediction models and in the design of a testing program, and to design special testing machines capable of both real-time and accelerated-wear and fretting-wear tests using a UH-1H helicopter cyclic servo support bearing as the test specimen. This particular component was selected because it was a relatively simple example of an actual component in which both wear and fretting-wear failure modes had been regularly observed in the field. GRA

N76-20130# Lockheed-California Co., Burbank.

INCREASED ROTOR BLADE SURVIVABILITY Final Report, 1 Jul. 1973 - 1 Jul. 1975

C. F. Griffin Aug. 1975 88 p refs
(Contract DAAJ02-73-C-0101; DA Proj. 1F1-63208-DB-52)
(AD-A016929; LR-26700; USAAMRDL-TR-75-6) Avail: NTIS CSCL 01/3

Reported are results of a program to investigate the feasibility of using composite geodesic structure for the blade spar to increase survivability of helicopter main rotor blades. The design investigated consists of a geodesic truss structure spare of elliptical cross section comprised of elements forming a redundant grid-work. This spar is covered with a thin composite expendable skin that forms the airfoil contour. Parametric analyses were conducted to determine the effects of geometry and materials on the strength and stiffness of geodesic structures. Subscale sections of the graphite/epoxy geodesic main rotor blade box spar were fabricated and tested. A graphite/epoxy geodesic helicopter main rotor blade preliminary design was completed, and four full-scale segments of this blade were fabricated and subjected to structural and ballistic tests. GRA

N76-20131# Army Air Mobility Research and Development Lab., Fort Eustis, Va.

FLIGHT TEST OF THE AEROSPATIALE SA-342 HELICOPTER

Duane R. Simon and Jimmie C. Savage Aug. 1975 74 p
(AD-A016921; USAAMRDL-TR-75-44) Avail: NTIS CSCL 01/3

The Eustis Directorate of the U.S. Army Air Mobility Research and Development Laboratory conducted an evaluation of the Aerospatiale Model SA-342 during November 1974. A total of 10 hours 20 minutes of flight time was accumulated during give test flights. Performance, stability, and control tests were performed to evaluate the increased capabilities of the SA-342 over the SA-341 upon which the design of the SA-342 is based. Both helicopters have fan-in-fin type antitorque control. The SA-342's handling qualities were generally very good, and it exhibited improved lateral-directional stability over the SA-341; however, trimming the aircraft directionally within the 'sideslip deadband' was still difficult. The improved fan provided sufficient control moment to attain 50 knots in sideward flight. It is recommended that additional effort be expended to explore and resolve problems with the fan-in-fin design experimental both by Aerospatiale and by Sikorsky Aircraft. GRA

N76-20132# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.

AN EVALUATION OF THE OPERATIONAL CAPABILITIES AND FUEL CONSERVATION IMPLICATIONS OF USING REMOTELY PILOTED VEHICLES, ADVANCED AIRCRAFT LIGHT SIMULATORS, AND LIGHTER-THAN-AIR AIRCRAFT M.S. Thesis

Kenneth P. OGorman, Richard L. Johnston, and Arthur E. Schwaninger Aug. 1975 149 p refs
(AD-A016393; SLSR-37-75B) Avail: NTIS CSCL 01/3

As early as 1950, the current world fuel energy crisis was predicted to occur. However, the warnings went unheeded until the oil embargo was initiated in 1973. Due to the resulting high cost and limited availability, the petroleum users of the world have attempted measures to conserve the use of fuel. In the United States, the Federal Government, specifically the Department of Defense, has implemented various measures and studies to reduce fuel consumption. This thesis researched literature in three areas--remotely piloted vehicles, advanced aircraft simulators, and lighter-than-air aircraft--to explore their operational capabilities and to evaluate any fuel energy benefits that may be derived from their use. The thesis concludes that remotely piloted vehicles and advanced aircraft flight simulators can be utilized to meet various operational requirements while reducing fuel consumption. However, lighter-than-air aircraft designs do not currently possess the technology needed to accomplish operational requirements while reducing fuel consumption. GRA

N76-20133# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

SUPPLEMENTARY REPORT ON RPV SYSTEM SIMULATION STUDY 2: EVALUATION OF RPV POSITION REPORT SMOOTHING AND AUTOMATIC HEADING CORRECTION Summary Report

Robert G. Mills, Robert F. Bachert, and Nilss M. Aume Sep. 1975 41 p
(AF Proj. 7184)
(AD-A017334; AMRL-TR-75-87) Avail: NTIS CSCL 01/3

The AMRL RPV System Simulation and Research Program was initiated in April 1973 in response to requirements for support of the design of the man-machine/environment interface of AF RPV systems. The major objectives of the AMRL RPV System Simulation and Research Program are as follows: (1) Perform RPV system design evaluation studies, i.e., evaluate alternative design configurations, assumptions, operating procedures, etc.; (2) assess RPV system effectiveness, i.e., evaluate the expected effectiveness of a given system configuration such as its overall probability of achieving a target, etc.; (3) provide man-machine/environment interface engineering data, i.e., recommend displays, etc.; (4) test bed new technology, i.e., evaluate effectiveness of contractor designed consoles, video bandwidth compression techniques, etc. GRA

N76-20134# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COCKPIT SYSTEMS STUDY YAK 40: RATING OF COCKPIT FACILITIES, FLIGHT AND SYSTEMS PROPERTIES OF THE AIRCRAFT BY PILOTS

K. Steininger and G. Neumann 25 Jun. 1975 64 p refs Transl. into ENGLISH from Deut. Luft Raumfahrt, Forchungsber. (Munich), v. 75, no. 15, 1975 p 1-70
(AD-A017198; FTD-ID(RS)I-1265-75) Avail: NTIS CSCL 01/2

An assessment by a representative sample of pilots employed by an airline to operate the Russian short haul jet transport plane YAK 40 is made of several features: Acceptability of the cockpit layout and instrumentation; handling qualities; feasibility of the systems with regard to the pilot's workload. GRA

N76-20135# ARO, Inc., Arnold Air Force Station, Tenn.

EFFECT OF THE GBU-15 (CRUCIFORM WING) AND GBU-15 (PLANAR WING) STORES ON THE AERODYNAMIC CHARACTERISTICS OF THE F-4C AIRCRAFT Final Report

Eddie S. Washington AEDC Sponsored by the AF Nov. 1975 69 p refs
(AF Proj. 2567)

(AD-A017378; ARO-PWT-TR-75-121; AEDC-TR-75-116; AFATL-TR-75-111) Avail: NTIS CSCL 01/3

A wind tunnel investigation was conducted to assess the effect of carriage of the GBU-15 (cruciform wing) and the GBU-15 (planar wing) stores on the longitudinal stability and drag characteristics of the F-4C aircraft. Data were obtained for 15 external store loading configurations for angles of attack ranging from -4 to 20 deg at 0-deg roll angle. All data were obtained at a constant stagnation pressure of 2,500 psia for Mach numbers from 0.6 to 1.1. GRA

N76-20136# Perkin-Elmer Corp., Norwalk, Conn.
DEVELOPMENT OF DEICING TECHNIQUES FOR DIELECTRIC WINDOWS Final Report, Apr. 1973 - Apr. 1975
Edward A. Strouse Aug. 1975 143 p refs
(Contract F33615-73-C-1080; AF Proj. 7371)
(AD-A017097; PE-12464; AFML-TR-75-99) Avail: NTIS CSCL 01/3

This report covers measurements and techniques that have led to the development of the first prototype windows coated with a continuous thin-film heater transparent in the 8 to 12 micron spectral region. The effort involved the measurement of the complex optical constants of indium-tin-oxide and the dependence of these values on both process parameters and the conductivity of the films. The performance of a full coated window has a transmission greater than 70%, and a sheet resistance of 160 ohms/square is described. Also included is a thermo-optical analysis of conductive films and patterns for zinc sulfide, zinc selenide, and zinc sulfo-selenide windows. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N76-20137# School of Aerospace Medicine, Brooks AFB, Tex.
A MINIATURE ENVIRONMENTAL MONITOR Initial Report, 1 Jul. 1974 - 1 May 1975
George R. James, Andrew O. Bergquist, and Doyle D. White Aug. 1975 12 p
(AF Proj. 7164)
(AD-A017208; SAM-TR-75-29) Avail: NTIS CSCL 01/3

A portable measuring device has been developed for assessment of cockpit/cabin environmental parameters during flight. The apparatus can be employed in a medium-sized aluminum suitcase as a single self-contained unit, or subunits and sensors can be deployed about the aircraft cockpit/cabin as conditions permit. For confined cockpits, a seatpack is used to contain subunits. The sensors include a hot-wire anemometer (sensitive from 0 to 400 ft/min), a dew point hygrometer (of range -40 to +50 C), an ambient temperature probe (0 to 100 C), and an absolute pressure transducer (0 to 800 mmHg). The output from each is linearized by internal circuitry and processed for both immediate digital display and simultaneous storage, together with time-code and voice record, on magnetic tape. The system's small size and flexible configuration permit derivation of mission-specific environmental profiles for aircraft ranging in size from single-place fighters to larger transport aircraft. Results obtained are useful in both the establishment of life support equipment design criteria and assessment of the physiological stresses of flight. Author (GRA)

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N76-20138+ Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.
BIBLIOGRAPHY ON AIRCRAFT NOISE
G. K. Troost Aug. 1975 47 p refs
(FOK-N-00-28) Avail: NTIS HC $4.00

Published literature concerning pure aerodynamic noise and its attenuation is listed. Noise from the intake and exhaust of the set engine of aircraft, propeller noise, detached flow and boundary layer noise, slits and resonant cavities, local vortices, and wakes of struts and antennas are considered. Propagation problems such as atmospheric attenuation, ground absorbtion and various shielding techniques are also discussed. ESA

N76-20139+ CIT Compagnie Industrielle des Telecommunications, Bruyeres-le-Chatel (France).
RESEARCH AND DEVELOPMENT OF A RADIAL TURBINE FOR SPECIAL TURBOCOMPRESSORS Final Report [ETUDE ET REALISATION D'UNE TURBINE RADIALE POUR TURBOCOMPRESSEURS SPECIAUX]
Jean Friberg and Jean-Marie Merigoux 23 May 1975 36 p In FRENCH
(Contract DGRST-72-7-0549)
Avail: NTIS HC $4.00

A radial turbine is proposed to replace a tandem of two axial turbines for application to small gas turbines or special turbocompressors with high compression ratio. The required quality criteria are detailed and compared to actual results. A general diagram for radial turbines was developed from theoretical studies and experimental results. ESA

N76-20140*# Pratt and Whitney Aircraft, East Hartford, Conn.
IMPROVED TURBINE DISK DESIGN TO INCREASE RELIABILITY OF AIRCRAFT JET ENGINES
A. S. Alver and J. K. Wong Oct. 1975 66 p ref
(Contract NAS3-18558)
(NASA-CR-134985; PWA-5329) Avail: NTIS HC $4.50 CSCL 21E

An analytical study was conducted on a bore entry cooled turbine disk for the first stage of the JT8D-17 high pressure turbine which had the potential to improve disk life over existing design. The disk analysis included the consideration of transient and steady state temperature, blade loading, creep, low cycle fatigue, fracture mechanics and manufacturing flaws. The improvement in life of the bore entry cooled turbine disk was determined by comparing it with the existing disk made of both conventional and advanced (Astroloy) disk materials. The improvement in crack initiation life of the Astroloy bore entry cooled disk is 87% and 67% over the existing disk made of Waspaloy and Astroloy, respectively. Improvement in crack propagation life is 124% over the Waspaloy and 465% over the Astroloy disks. The available kinetic energies of disk fragments calculated for the three disks indicate a lower fragment energy level for the bore entry cooled turbine disk. Author

N76-20141*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TWO-POINT CORRELATIONS OF SOUND PRESSURE IN THE FAR FIELD OF A JET: EXPERIMENT
Lucio Maestrello Apr. 1976 22 p refs Presented at the 91st Meeting of the Acoustical Soc. of Am., Washington, D. C., 5-9 Apr. 1976
(NASA-TM-X-72835) Avail: NTIS HC $3.50 CSCL 20A

Correlations of sound pressure between two microphones yield substantially more information than single microphone data; hence, they provide useful information about the nature and behavior of jet noise sources as a basis for theory development. The mapping of the space-time correlations of the pressure over a distant sphere enclosing a subsonic jet revealed a number of previously unaccounted for features essential for the interpretation of the radiation field and for the modeling of the flow field. Author

N76-20142*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
QUIET, CLEAN SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE) TEST RESULTS FROM A 14 cm INLET FOR A VARIABLE PITCH FAN THRUST REVERSER
W. F. Vier Dec. 1975 34 p refs

(Contract NAS3-18021)
(NASA-CR-134867; R75AEG387) Avail: NTIS HC $4.00 CSCL 21E

A 1/13th scale model of the fan discharge duct was tested with a matrix of flare exlets. Exlets are flared fan nozzles configured for improved reverse flow inlet performance for reverse pitch fan applications. Results showed that a flare type exlet is an acceptable design for QCSEE, as indicated by high pressure recovery and low distortion performance. Author

N76-20143*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF FLARED FAN NOZZLES USED AS INLETS
Donald A. Dietrich, Theo G. Keith, and Gary G. Kelm Washington Mar. 1976 31 p refs
(NASA-TM-X-3367; E-8539) Avail: NTIS HC $4.00 CSCL 21E

Tests were conducted in a low speed wind tunnel to determine the aerodynamic performance of several flared fan nozzles. Each of the flared nozzles was a downstream-facing inlet to a model fan that was used to simulate a variable pitch fan during reverse thrust operation. The total pressure recovery of each of the flared nozzles as well as that of an unflared nozzle and a serrated flare nozzle was obtained for comparison. The aerodynamic performance of a selected flared nozzle was considered in further detail. The nozzle surface pressures for a flared nozzle were also determined. Results indicated that the differences in aerodynamic performance among the nozzles were most apparent at the wind-tunnel-off condition. A nonzero free stream velocity significantly reduced the perforamnce of all the nozzles, and crosswind flow (free stream flow perpendicular to the model axis) further reduced the performance of the nozzles. The unflared nozzle and the serrated flare nozzle had reduced aerodynamic performance compared to a solid surface flared nozzle. Author

N76-20144*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY STUDY OF TRANSIENT UPSTART PHENOMENA IN A THREE-DIMENSIONAL FIXED-GEOMETRY SCRAMJET ENGINE
Allan R. Wieting Washington Mar. 1976 20 p refs
(NASA-TN-D-8156; L-10643) Avail: NTIS HC $3.50 CSCL 21E

The structural and thermal design of a hydrogen fueled regeneratively cooled three dimensional fixed geometry scramjet was examined. An exploratory study was conducted at Mach 5.3 in the 7-inch Mach 7 pilot tunnel to investigate the unstart phenomena and to provide the experimental data base required to predict the design pressure loads. The test results indicate that the peak pressures occurred during the transient unstart and not during steady state started or unstarted flow conditions. The local peak pressures can be conservatively predicted by normal shock wave theory as the peak approaches the pressure that would exist behind a stationary normal shock with an upstream Mach number equal to the area weighted local Mach number for the normal started condition. Author

N76-20145*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FLAME STABILIZER DESIGN ON PERFORMANCE AND EXHAUST POLLUTANTS OF A TWO-ROW 72-MODULE SWIRL-CAN COMBUSTOR
James A. Biaglow and Arthur M. Trout Washington Mar. 1976 23 p refs
(NASA-TM-X-3373; E-8564) Avail: NTIS HC $3.50 CSCL 21E

A test program was conducted to evaluate the effects of four flame stabilizer designs on the performance and gaseous pollutant levels of an experimental full-annular swirl-can combustor. Combustor operating parameters, including inlet-air temperature, reference velocity, and fuel-air ratio, were set to simulate conditions in a 30:1 pressure ratio engine. Combustor inlet total pressure was held constant at 6 atm due to the facility limit. Combustor performance and gaseous pollutant levels were strongly affected by the geometry and resulting total pressure loss of the four flame stabilizer designs investigated. The addition of shrouds to two designs produced an 18 to 22% decrease in the combustion chamber pressure loss and thus resulted in doubling the exit temperature pattern factor and up to 42% higher levels of oxides of nitrogen. A previously developed oxides of nitrogen correlating parameter agreed with each model within an emission index of plus or minus 1 but was not capable of correlating all models together. Author

N76-20146*# Pratt and Whitney Aircraft, East Hartford, Conn.
DESIGN OF A 4 1/2 STAGE TURBINE WITH A STAGE LOADING FACTOR OF 4.66 AND HIGH SPECIFIC WORK OUTPUT Final Report
P. F. Webster Washington NASA Mar. 1976 138 p refs
(Contract NAS3-18033)
(NASA-CR-2659; PWA-5101) Avail: NTIS HC $6.00 CSCL 21E

The aerodynamic design of a highly loaded multistage fan drive turbine is discussed. Turbine flowpath and airfoil sections are presented along with respective pressure and velocity distributions. Vibrational modes are identified in the expected turbine operating range. Author

N76-20147# European Space Agency, Paris (France).
ON COMPRESSIBLE FLOW IN AN INLET PIPE WITH SUDDEN EXPANSION
Werner Dobrzynski Dec. 1975 31 p refs Transl. into ENGLISH of 'Ueber kompressible Einlaufstroemungen in einem Rohr mit unstetiger Erweiterung', DFVLR, Brunswick Report DLR-FB-75-06, 1975 Original German report available from DFVLR, Porz, West Ger, DM 14.40
(ESA-TT-219; DLR-FB-75-06) Avail: NTIS HC $4.00

In connection with the design of a pulsejet engine, a test model consisting of two pipes of different diameters joined together, was exposed to a free jet of air at Mach numbers of M = 0.5 to 1.0. The internal flow was determined by means of pressure measurements. An axial pressure gradient occurs in the inlet pipe, due chiefly to the development of a turbulent velocity profile. A loss of total pressure occurs after the sudden enlargement of the pipe, its magnitude being a function of the local Mach number. The level of pressure in the plane of the increase in pipe area was determined essentially by this loss of total pressure, as well as by geometrical quantities. All the results are valid only for a constant area ratio between inlet and exhaust pipe. Author (ESA)

N76-20148# Marquardt Corp., Van Nuys, Calif.
LOW COST HYPERMIXING EJECTOR RAMJET PROGRAM Final Report, 15 Jun. 1973 - 10 Feb. 1975
Joseph G. Bendot, Wallace G. Harkins, and Thomas G. Piercy Wright-Patterson AFB, Ohio ARL 8 Jun. 1975 199 p refs
(Contract F33615-73-C-4093; AF Proj. 7116)
(AD-A016430; MR-S-1322-A; ARL-75-0219) Avail: NTIS CSCL 21/5

The Air Force Aerospace Research Laboratories (ARL) recently made a technology breakthrough in the field of turbulent mixing. ARL experiments indicated that the spreading rate of a subsonic jet may be increased dramatically by the introduction of streamwise vortices in the flow. These vortices promote efficient turbulent mixing within an extremely short distance, i.e., hypermixing. The basic objective of this program was to assess the payoff, if any, of applying hypermixing ejector technology to the design of a low cost ejecto ramjet engine. Three variations of the ejector ramjet engine cycle were evaluated at the engine design point of Mach 0.75 at 20,000 feet altitude. The fuel addition-mix/diffuse/burn cycle variation was clearly superior. The selected fuel was UDMH. Engine performance was estimated for the specified flight envelope, Mo equals 0.70 to 1.20 and sea level to 30,000 feet altitude. An annular ring ejector which incorporated hypermixing technology was designed, fabricated, and experimentally evaluated. Test results showed no improvement with the hypermixing ejector as compared to a conventional annular ejector. The test ejector was then modified. A second test series showed this modification to be very effective. Full mixing (maximum mixer total pressure) was achieved in one half the length required for the annular/initial hypermixing ejector. At the ejector design point, full mixing was accomplished in 1.7 duct diameters. GRA

N76-20149# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INVESTIGATION OF THE STATIC THRUST AUGMENTATION CAPABILITIES OF A DIVERGENT EJECTOR-AFTERBURNER M.S. Thesis
Carl H. Steiling, Jr. Jun. 1975 115 p refs
(AD-A017458; GA/ME/75J-1) Avail: NTIS CSCL 21/5

The effects on static thrust augmentation and mass entrainment of various divergent ejector-afterburner configurations were investigated. Static tests were conducted using a gaseous oxygen/hydrogen sonic rocket as the primary gas generator. Configurations included various length mixing ducts, two different size diffusers, burn ducts, and secondary nozzles. Oxydizer-to-fuel mixture ratio was varied from .3 to 1.5 at 80 psia chamber pressure. Results indicated maximum static thrust augmentation (22%0 when the relatively unmixed primary and secondary streams were diffused immediately after the secondary inlet and then allowed to complete mixing in a constant area duct, for a total afterburner length of about six inlet diameters. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-20150*# Boeing Commercial Airplane Co., Seattle, Wash.
DEVELOPMENT OF WEIGHT AND COST ESTIMATES FOR LIFTING SURFACES WITH ACTIVE CONTROLS Final Report
R. D. Anderson, C. C. Flora, R. M. Nelson, E. T. Raymond, and J. H. Vincent Mar. 1976 94 p refs
(Contract NAS1-14064)
(NASA-CR-144937) Avail: NTIS HC $5.00 CSCL 01C

Equations and methodology were developed for estimating the weight and cost incrementals due to active controls added to the wing and horizontal tail of a subsonic transport airplane. The methods are sufficiently generalized to be suitable for preliminary design. Supporting methodology and input specifications for the weight and cost equations are provided. The weight and cost equations are structured to be flexible in terms of the active control technology (ACT) flight control system specification. In order to present a self-contained package, methodology is also presented for generating ACT flight control system characteristics for the weight and cost equations. Use of the methodology is illustrated. Author

N76-20151*# Systems Technology, Inc., Hawthorne, Calif.
MANUAL AND AUTOMATIC FLIGHT CONTROL DURING SEVERE TURBULENCE PENETRATION Final Report
Donald E. Johnston, Richard H. Klein, and Roger H. Hoh Washington NASA Apr. 1976 110 p refs
(Contract NASw-2624)
(NASA-CR-2677; TR-1049-1) Avail: NTIS HC $5.50 CSCL 01C

An analytical and experimental investigation of possible contributing factors in jet aircraft turbulence upsets was conducted. Major contributing factors identified included autopilot and display deficiencies, the large aircraft inertia and associated long response time, and excessive pilot workload. An integrated flight and thrust energy management director system was synthesized. The system was incorporated in a moving-base simulation and evaluated using highly experienced airline pilots. The evaluation included comparison of pilot workload and flight performance during severe turbulence penetration utilizing four control/display concepts: manual control with conventional full panel display, conventional autopilot (A/P-A) with conventional full panel display, improved autopilot (A/P-B) with conventional full panel display plus thrust director display, and longitudinal flight director with conventional full panel display plus thrust director display. Simulation results show improved performance, reduced pilot workload, and a pilot preference for the autopilot system controlling to the flight director command and manual control of thrust following the trim thrust director. Author

N76-20152# European Space Agency, Paris (France).
MEASUREMENTS OF THE VERTICAL MOVEMENTS OF AN AIRCRAFT
Heinz Winter et al Dec. 1975 80 p refs Transl. into ENGLISH of 'Messung der Vertikalbewegungen eines Flugzeugs', DFVLR, Brunswick Report DLR-FB-75-41, 5 May 1975 Original German report available from DFVLR, Cologne DM 28,00
(ESA-TT-215; DLR-FB-75-41) Avail: NTIS HC $5.00

The measuring accuracy for aircraft altitude and vertical velocity, which can be obtained by combining the information of the vertical channel of an inertial navigation system, of a barometric altimeter, and of a tracking radar in a Kalman filter, was analyzed. Results are based on a flight test with the HFB 320 aircraft. Author (ESA)

N76-20153# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF OPTIMAL CONTROL THEORY PREDICTIONS WITH ACTUAL PILOT PERFORMANCE IN A HELICOPTER LONGITUDINAL TRACKING TASK M.S. Thesis
Luther William Wheat Jun. 1975 44 p refs
(AD-A016441) Avail: NTIS CSCL 01/3

A fixed base helicopter simulation was implemented which may be easily altered to represent a variety of conventional single rotor aircraft. Test subjects performed 90-second tracking tasks utilizing two cockpit displays for longitudinal control during landing approach. The performance data generated were compared with predicted values from an optimal pilot modeling technique. Tentative conclusions were drawn as to the effectiveness of each display as well as the predictive power of the pilot model. GRA

N76-20154# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
ROLL-AXIS HYDROFLUIDIC STABILITY AUGMENTATION SYSTEM DEVELOPMENT Final Report, 29 Mar. 1973 - 30 Sep. 1974
Darroll Bengtson, Thomas Dickovich, and Robert Helfenstine Sep. 1975 137 p
(Contract DAAJ02-73-C-0056; DA Proj. 1F1-62204-AA-44)
(AD-A016932; GAPD-W0528-FR; USAAMRDL-TR-75-43)
Avail: NTIS CSCL 01/3

The objective of this program was to develop, design, and flight test a roll-axis Hydrofluidic Stability Augmentation System (HYSAS) for the OH-58A helicopter. The system, when used with a yaw HYSAS, provides increased vehicle damping which improves the handling characteristics. Flight test evaluations were performed with satisfactory results. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-20155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MODEL INVESTIGATION OF INLET PLENUM FLOW STRAIGHTENING TECHNIQUES FOR ALTITUDE TEST FACILITY
Stephen M. Riddlebaugh and Heinz G. Linke Washington Feb. 1976 32 p
(NASA-TM-X-3348; E-8464) Avail: NTIS HC $4.00 CSCL 14B

An investigation was conducted to evaluate and improve the quality of the airflow to be supplied to the engine in altitude test chambers 3 and 4 of the Propulsion Systems Laboratory at the Lewis Research Center. One-twentieth-scale models of the inlet plenum chamber of the two test chambers were used in the investigation to minimize time and cost. It was possible to reduce the velocity spread in the inlet plenum from approximately 100 m/sec (330 ft/sec) to approximately 10 m/sec (30 ft/sec) through the combined use of flow diverters, multiple spaced screens, flow straighteners, and turning vanes. Author

N76-20156# National Research Council of Canada, Ottawa (Ontario).
[MECHANICAL ENGINEERING AND AERONAUTICAL RESEARCH PROJECTS] Quarterly Bulletin, 1 Oct. - 31 Dec. 1975
31 Dec. 1975 90 p refs
(DME/NAE-1975(4); ISSN-0047-9055) Avail: NTIS HC $5.00

Lift fan noise reduction and a Canadian playback and flight recording center for aircraft accident and/or incident investigations are summarized. For individual titles, see N76-20157 through N76-20158.

N76-20157 National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
THE NATIONAL AERONAUTICAL ESTABLISHMENT FLIGHT RECORDER PLAYBACK CENTRE
B. Caiger *In* Natl. Res. Council Can. Mech. Eng. and Aeron. Res. Proj. 31 Dec. 1975 p 1-36 ref (For availability see N76-20156 11-09)

A playback center designed to handle all cockpit voice recorders and flight data recorders fitted to Canadian civil and military transport aircraft is described. Recorders are forwarded to the Center whenever incidents or accidents warrant investigation by the authorities concerned. The playback facilities were designed with special emphasis on the problems that might be encountered in these cases. Routine monitoring is also conducted on the military systems for maintenance purposes. Current and future capabilities of the Center are summarized and examples given of some of the work that was done. The types of recorders that are routinely handled are given and digital data formats that can be processed are listed. Author

N76-20158 Division of Mechanical Engineering, Ottawa (Ontario). Engine Lab.
AN ANECHOIC TEST CELL FOR FAN NOISE RESEARCH
G. Krishnappa *In* Natl. Res. Council Can. Mech. Eng. and Aeron. Res. Proj. 31 Dec. 1975 p 37-84 refs (For availability see N76-20156 11-09)

A description of the fan noise research test cell is given. Acoustic measurements inside the treated area of the cell showed satisfactory performance of the test area for fan noise research. Noticeable deviations from the inverse square law variations were observed only at low frequencies near the inlet splitters and flow straighteners, and near the crane rail surface on the ceiling. The agreement of the measured sound pressure levels with the inverse square law variation was excellent across the width of the cell. Uses of the cell for other machinery noise measurements are discussed. Author

N76-20159*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TEST PLANE UNIFORMITY ANALYSIS FOR THE MSFC SOLAR SIMULATOR LAMP ARRAY
Donald B. Griner Mar. 1976 42 p
(NASA-TM-X-64991) Avail: NTIS HC $4.00 CSCL 14B

A preliminary analysis was made on the solar simulator lamp array. It is an array of 405 tungsten halogen lamps with Fresnel lenses to achieve the required spectral distribution and collimation. A computer program was developed to analyze lamp array performance at the test plane. Measurements were made on individual lamp lens combinations to obtain data for the computer analysis. The analysis indicated that the performance of the lamp array was about as expected, except for a need to position the test plane within 2.7 m of the lamp array to achieve the desired 7 percent uniformity of illumination tolerance. Author

N76-20160# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
AERODYNAMIC REENTRY PROBLEMS IN WIND TUNNEL FACILITIES AT LOW DENSITIES AND HIGH ENERGIES
Manfred Becker 9 Sep. 1975 61 p refs In GERMAN; ENGLISH summary Presented at the Seminar on 'Rueckkehrtechnol.' of the Tech. Univ., Munich, Feb. 1974 Report will also be announced as translation
(DLR-Mitt-75-16) Avail: NTIS HC $4.50; DFVLR, Cologne DM 23.70

Some reentry phenomena are discussed based on concepts of mean free path, viscosity, number density, deceleration, and aerodynamic heating. The facilities in Koeln-Porz, including measurement techniques, are described. Some investigations and possibilities of further application are discussed. Investigations performed on simple reentry bodies are summarized. Author (ESA)

N76-20161# European Space Agency, Paris (France).
STRUCTURAL VIBRATION TEST METHODS USED BY ONERA
Rolland Dat Dec. 1975 29 p refs Transl. into ENGLISH of "Les Methodes d'Essai de Vibration des Structures Exploitees par l'ONERA", ONERA, Paris Report ONERA-P-1975-1, 1975 (ESA-TT-221; ONERA-P-1975-1) Avail: NTIS HC $4.00

The equipment and methods described are used for determining the dynamic characteristics of structures (normal modes or transfer functions) under the most difficult conditions. The methods are based on the assumption of linearity but the experience gained permits extending these methods to actual structures, which are often nonlinear (presence of dry friction or stiffness nonlinearities). Author (ESA)

N76-20162# Dikewood Corp., Albuquerque, N.Mex.
PROGRAM MILESTONES FOR NEAR-TERM-COR Final Report
Robert L. Stohler Kirtland AFB, N. Mex. AFSWC Oct. 1975 29 p ref
(Contract F29601-74-C-0022)
(AD-A016453; DC-TR-1242-2; AFSWC-TR-75-6) Avail: NTIS CSCL 14/2

The report represents a first attempt to define the Near-Term COR (Continental Operations Range) configuration. Assumptions of equipment availability and interaction are presented in a 'PERT' type format to provide visibility for the effort involved. Because the preliminary planning for COR is not complete, and the integration contractor effort has not yet been defined, no specific times could be presented. Equipment configuration was based on support of the EWJT and buildup of a microwave communications systems. GRA

N76-20163# Naval Air Test Facility, Lakehurst, N.J.
TEST CAPABILITIES OF THE STEAM CATAPULTS LOCATED AT THE NAVAL AIR TEST FACILITY
Edward J. Yesunas 17 Oct. 1975 36 p refs
(AD-A017582; NATF-EN-1134) Avail: NTIS CSCL 13/10

This report provides relevant information regarding the test capabilities of the steam catapults located at the Naval Air Test Facility, Lakehurst, New Jersey. The catapults are used in conjunction with aircraft, deadload vehicles, and deadload-mounted platforms to provide the means for diversified linear acceleration test programs. GRA

N76-20164# New Mexico Univ., Albuquerque. Eric H. Wang Civil Engineering Research Facility.
AFPAV COMPUTER CODE FOR STRUCTURAL ANALYSIS OF AIRFIELD PAVEMENTS Final Report
John P. Nielsen Kirtland AFB, New Mex. AFWL Oct. 1975 75 p refs
(Contract F29601-74-C-0030; AF Proj. 683M)
(AD-A016428; AFWL-TR-75-151) Avail: NTIS CSCL 01/5

This report is a user's manual for the implementation and use of the AFPAV computer code for the structural analysis of airfield pavements. The code provides for linear and nonlinear material properties and stress analyses for single and multiwheel aircraft. A plot routine is included in AFPAV to provide for a graphical presentation of the computed data. Author (GRA)

N76-20165# Naval Civil Engineering Lab., Port Hueneme, Calif.
A STRUCTURAL EVALUATION OF RAPID METHODS OF BACKFILLING FOR BOMB DAMAGE REPAIR, PHASE 2 Final Report, Apr. 1973 - Aug. 1974
John Crawford and James B. Forrest Kirtland AFB, New Mex. AFWL Aug. 1975 87 p refs Sponsored by AFWL
(AD-A016498; AFWL-TR-74-272) Avail: NTIS CSCL 01/5

An analytical model for evaluating the performance of repair systems for bomb-damaged runways is presented. This model consists of a finite element computer code capable of predicting

the response of a repaired crater to an applied single wheel load, placed at the center of the repaired surface. Variables investigated during development of the analytical model include different element meshes, number of load steps, material stiffnesses and tension cutoff levels. Background information dealing with application of the model and generation of its input is included. Verification of this prediction technique is presented, based upon experimental testing of repaired model craters and repaired prototype 750-pound bomb craters. The prototype crater was repaired using the procedure recommended in Air Force Manual 93-2. The analytical model is shown to give valid predictions of the repair system response as long as reasonable attention is directed toward generation of input information. GRA

N76-20166# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION. REPORT 17-3 LONGSHORE WAVE ENERGY ANALYSES
Douglas G. Outlaw and Donald L. Durham Sep. 1975 179 p
(AD-A016900; AEWES-TR-H-74-6-17-3) Avail: NTIS CSCL 01/5

The Lake Erie Regional Transportation Authority (LERTA) is conducting a feasibility and site selection study for a major hub airport in the Cleveland Area. One of the possible sites being evaluated is an offshore site in Lake Erie near Cleveland, Ohio. As a part of the feasibility analysis of an offshore site, the U.S. Army Engineer Waterways Experiment Station (WES) is conducting a model feasibility investigation. This report, which is the third of a series, presents results of the longshore wave energy analyses. GRA

N76-20167# Transportation Research Board, Washington, D.C.
PAVEMENT REHABILITATION Final Report
Jun. 1974 242 p refs Proc. held at San Francisco, 19-22 Sep. 1973
(Contract DOT-OS-40022-1)
(PB-246801/5; FHWA-RD-74-60) Avail: NTIS HC $8.00 CSCL 13C

A three and one-half day workshop was used as a forum to examine the broad field of pavement rehabilitation and related strategies applicable to both highways and airfields. Prepared state of the art papers were presented to document knowledge impinging on the pavement maintenance processes. These papers were used as background material for study by small working groups. A proposed research framework was formulated from an appraisal and evaluation of the workshop deliberations. GRA

N76-20168# Mitre Corp., McLean, Va.
AIRPORT SURFACE TRAFFIC CONTROL SYSTEMS DEVELOPMENT ANALYSIS: EXPANDED Final Report, Jan. 1973 - Feb. 1974
R. A. Bales and J. F. Koetsch Mar. 1975 116 p refs
(Contract DOT-TSC-RA-73-11)
(AD-A013579; FAA-RD-75-51) Avail: NTIS CSCL 17/7

A previous MITRE Technical Report, Airport Surface Traffic Control Systems Deployment Analysis, FAA-RD-74-6, presented an analysis of ASTC (Airport Surface Traffic Control) system requirements and developed estimates of the deployment potential of proposed ASTC system alternatives for 19 air carrier airports. The primary requirement was determined to be improved surveillance which resulted in an estimated deployment of one of two surveillance systems at 16 airports by 1980. This report presents an expansion of that deployment analysis to include a total of 39 air carrier airports. The methods and assumptions for the deployment analysis of the 20 airports presented in this report are essentially the same as in the initial report. The overall result of the analysis is that by the initial deployment date (1976-1980) of the two alternative surveillance systems, the total potential market will be for 20-25 systems. By the end of the century, the total potential market for ASTC surveillance systems will exceed 30. GRA

N76-20169# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
FEASIBILITY DETERMINATION OF A DYNAMIC TAXI FACILITY FOR EVALUATING MILITARY LANDING GEAR SYSTEMS Final Report, May - Dec. 1973
Howard T. Anderle and Joseph G. Mercer Jul. 1975 103 p refs
(AF Proj. 1369)
(AD-A017038; AFFDL-TR-74-111) Avail: NTIS CSCL 01/3

A feasibility study of using a hydraulic vibration machine in conjunction with a drop tower to evaluate ride quality characteristics of a landing gear was made. For sinusoidal inputs over a frequency-double amplitude range of 1-5 Hz and 0.6 to 1.0 inches, amplitude-ratio frequency response of the drop jig was measured. This was done while varying strut pneumatic stiffness and strut friction. This work definitely shows feasibility of a laboratory experimental setup to test ride quality effectiveness of a landing gear. GRA

N76-20170# Factory Mutual Research Corp., Norwood, Mass.
FIRE PROTECTION OF LARGE AIR FORCE HANGARS Final Report
L. M. Krasner, P. M. Fitzgerald, and D. E. Breen Oct. 1975 62 p refs
(Contract F29601-74-C-0052; AF Proj. 2102)
(AD-A017545; FMRC-22445; AFWL-TR-75-119) Avail: NTIS CSCL 01/5

This report describes a study related to the fire protection of large aircraft hangars. The study directly develops and augments a previous effort completed for the Air Force Weapons Laboratory in April 1974. This report discusses the attenuation of Aqueous Film-Forming Foam (AFFF) in an environment of elevated temperature, foam particle fire plume penetration, supplementary low-level foam systems, floor drainage systems and draft curtains. In addition, 900-sq ft JP-4 fire test results are discussed. The tests were the major effort of the program and were intended to evaluate the general effectiveness of 3 percent and 6 percent AFFF when discharged singly and jointly from overhead and ground level. The results of the study discussed in this report indicate that FC-203 is an extremely effective deluge system agent when applied at design densities of 0.16 gpm/sq ft but dramatically loses effectiveness when applied at a rate of 0.125 gpm/sq ft; at an application rate of 0.1 gm/sq ft an oscillating monitor nozzle is capable of achieving 90 percent fire control in 30 to 45 sec under optimum conditions, a performance capable of aircraft protection; and the potential for large reduction in water demand with no sacrifice to fire fighting effectiveness exists with closed heat AFFF sprinkler systems in hangars, as contrasted with AFFF deluge systems.
Author (GRA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

No abstracts in this category.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-20171*# Georgia Inst. of Tech., Atlanta.
EXPERIMENT DEFINITION USING THE SPACE LABORATORY, LONG DURATION EXPOSURE FACILITY, AND SPACE TRANSPORTATION SYSTEM SHUTTLE Final Report
Albert P. Sheppard and Joan M. Wood 14 Mar. 1976 74 p refs
(Grant NsG-1200)
(NASA-CR-146658) Avail: NTIS HC $4.50 CSCL 22A

Candidate experiments designed for the space shuttle transportation system and the long duration exposure facility are summarized. The data format covers: experiment title, Experimenter, technical abstract, benefits/justification, technical discussion of experiment approach and objectives, related work

and experience, experiment facts space properties used, environmental constraints, shielding requirements, if any, physical description, and sketch of major elements. Information was also included on experiment hardware, research required to develop experiment, special requirements, cost estimate, safety considerations, and interactions with spacecraft and other experiments.
Author

N76-20172# Centre National d'Etudes Spatiales, Toulouse (France).
NAUTEX PROJECT: STUDY OF GRAVITATIONAL STABILIZATION OF A DRAG-FREE SATELLITE [PROJECT NAUTEX - ETUDE DE L'EQUILIBRAGE GRAVIFIQUE D'UN SATELLITE A TRAINEE COMPENSEE]
Bruno Belon, Michel Courtois, and Jean-Claude Kosik Jul. 1975 105 p refs In FRENCH; ENGLISH summary
(CNES-NT-22) Avail: NTIS HC $5.50

A method to evaluate the internal gravitational field of a drag free satellite is described. Different kinds of errors are taken into account: modeling, mass measurements, position, inertia, and non-homogeneity. Different criteria were selected to optimize the geometrical distribution of the masses of the spacecraft. Three configurations of spacecraft were tested with this method which leads to an internal gravitational field of less than 10 sup (-9) m/sq s in a spherical zone of 1 mm radius in the vicinity of the center of mass. Author (ESA)

N76-20173# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
IMPACT OF EXTERNAL ENVIRONMENTAL FACTORS ON MINUTEMAN 3 INERTIAL GUIDANCE SYSTEM NS-20 FAILURES M.S. Thesis
Gerald L. Clemons and Chris A. Schell Aug. 1975 218 p refs
(AD-A016392; SLSR-27-75B) Avail: NTIS CSCL 16/4

This study is a preliminary search to determine if a relationship exists between Minuteman 3 Guidance System (NS-20) failures and the external environmental factors of temperature, wind speed, wind direction, humidity, and barometric pressure. Multiple regression analysis was used to determine what degree of relationship, if any, existed between NS-20 failures and several combinations of environmental factors. The search was extended to determine whether or not a relationship existed between external environmental factors and the failure of subcomponents of the NS-20, i.e., the Digital Computer Unit (DCU) and the Pendulous Integrating Gyroscopic Assembly (PIGA). Environmental conditions existing at the time of failure and prior to the time of failure were included. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N76-20174*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
ATS-F GROUND STATION INTEGRATION Final Report
2 Jun. 1975 183 p refs
(Contract NAS5-21548)
(NASA-CR-144735; FIS-75-0032) Avail: NTIS HC $7.50 CSCL 22D

The ATS ground stations were described, including a system description, operational frequencies and bandwidth, and a discussion of individual subsystems. Each station configuration is described as well as its floor plan. The station performance, as tested by the GSI, is displayed in chart form providing a summary of the more important parameters tested. This chart provides a listing of test data, by site, for comparison purposes. Also included is a description of the ATS-6 experiments, the equipment, and interfaces required to perform these experiments. The ADP subsystem and its role in the experiments is also described. A description of each program task and a summary of the activities performed were then given. These efforts were accomplished at the Rosman II Ground Station, located near Rosman N.C., the Mojave Ground Station, located near Barstow Ca., and the GSI Contractors plant located near Baltimore, Md.
Author

N76-20175# European Space Research and Technology Center, Noordwijk (Netherlands).
FUEL-SLOSH TEST RIGS FOR GEOS AND METEOSAT. DESIGN STUDY, MANUFACTURE AND TESTING
J. W. Rowley Paris ESRO Oct. 1975 19 p
(ESA-TM-163-ESTEC) Avail: NTIS HC $3.50

The development of two test rigs intended to enable the effects of fuel sloshing on spacecraft nutation damping to be investigated is described. The problems encountered with material acquisition and with design, manufacture, and testing of rigs are enumerated, together with their solutions. Fuel slosh tests are to be carried out at NASA GSFC as part of the GEOS and Meteosat programs. Areas particularly investigated are: positioning of tanks (three for Meteosat and two for GEOS), securing of tanks to rigs, positioning of passive nutation damper for Meteosat, and the interface between the test rigs and the NASA air-bearing table and positioning of Meteosat rigs in two vertical positions about the Z-axis. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-20176*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
EXPERIMENTAL EVALUATION OF OUTER PLANETS PROBE THERMAL INSULATION CONCEPTS
M. G. Grote and S. A. Mezines Mar. 1976 81 p refs
(Contract NAS2-7328)
(NASA-CR-137812) Avail: NTIS HC $5.00 CSCL 22B

An experimental program was conducted to evaluate various thermal insulation concepts for use in the Outer Planets Probe (OPP) during entry and descent into the atmospheres of Jupiter, Saturn, and Uranus. Phenolic fiberglass honeycomb specimens representative of the OPP structure were packed and tested with various fillers: Thermal conductivity measurements were made over a temperature range of 300 K to 483 K and pressures from vacuum up to 10 atmospheres in helium and nitrogen gas environments. The conductivity results could not be fully explained so new test specimens were designed with improved venting characteristics, and tested to determine the validity of the original data. All of the conductivity data showed results that were substantially higher than expected. The original test data in helium were lower than the data from the redesigned specimens, probably due to inadequate venting of nitrogen gas from the original specimens. The thermal conductivity test results show only a marginal improvement in probe thermal protection performance for a filled honeycomb core compared to an unfilled core. In addition, flatwise tension tests showed a severe bond strength degradation due to the inclusion of either the powder or foam fillers. In view of these results, it is recommended that the baseline OPP design utilize an unfilled core. Author

N76-20177# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
A GENERAL APPROACH TO THE SHADED SUN SENSOR MODELING PROBLEM WITH AN APPLICATION TO THE FLTSATCOM SHADED SUN SENSORS Final Report
K. K. Wong 25 Aug. 1975 41 p refs
(Contract F04701-75-C-0076)
(AD-A016529; SAMSO-TR-75-243; TR-0076(6724-02)-1) Avail: NTIS CSCL 22/2

Sun sensors are widely used in space vehicles for sun acquisition or determination of body attitude relative to the sun. In order to alleviate undesirable reflections from the various parts of the vehicle, shades are often introduced about the sun

sensitive device. The added nonlinearity in the attitude control system due to the effect of shading alters the stability margin and degrades the analytical results obtained from the linearized approach. A general approach is presented in this paper on the modeling of shaded sun sensors. The approach applies to shading wall geometry and solar cells whose boundaries can be described or approximated by a piecewise linear relation. The output of the cell, which depends on the sun angle and the shade dimensions, is a function of the intersection of the shade pattern with the cell area. Having defined the shade structure by vectors fixed in the sensor's coordinate frame, the shade contribution due to each partitioned shade structure is calculated sequentially so that it is not necessary to define an integral shade pattern and various boundary conditions. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N76-20178*# Aerospace Corp., El Segundo, Calif.
SHUTTLE USER ANALYSIS (STUDY 2.2). VOLUME 1: EXECUTIVE SUMMARY Final Report
30 Sep. 1974 28 p refs
(Contract NASw-2575)
(NASA-CR-146661; ATR-74(7342)-1-Vol-1) Avail: NTIS HC $4.00 CSCL 22B

The following tasks related to the FY 74 Shuttle Users Analysis were completed: (1) STS user charge analysis, (2) business risk and value of operations in space (BRAVO) analysis, and (3) standardized subsystem module analysis. The first task was required to initiate the process of furnishing transportation charge estimates for STS payloads to STS users. Author

N76-20179*# Scientific Translation Service, Santa Barbara, Calif.
VACATION IN SPACE
Piet Smolders Washington NASA Apr. 1976 11 p Transl. into ENGLISH from De Jonge Onderzoekers (Netherlands), no. 2, Feb. 1976 p 32-35
(Contract NASw-2791)
(NASA-TT-F-16979) Avail: NTIS HC $3.50 CSCL 22A

A description is given of plans for a space plane including that of the United States planned for 1980. Drawings are given of designs for future space planes. Author

N76-20180*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE PRODUCTION OF NITRIC OXIDE IN THE TROPOSPHERE AS A RESULT OF SOLID-ROCKET-MOTOR AFTERBURNING
Roger B. Stewart and Richard I. Gomberg Washington Mar. 1976 45 p refs
(NASA-TN-D-8137; L-10594) Avail: NTIS HC $4.00 CSCL 13B

As part of an ongoing assessment of the environmental effects of solid-rocket-motor operations in the troposphere, estimates were made of the nitric oxide produced in the troposphere by the space shuttle and Titan 3-C boosters. Calculations were made with the low-altitude plume computer program and included the effects of coupled finite-rate chemistry and turbulent mixing. A recent measurement of nitric oxide taken in the effluent cloud of a Titan 3-C booster is compared with calculations made with this computer code. The various chemical reactions of the exhaust gases are listed in tabular form. Author

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-20181*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
ANALYSIS OF TEST DATA ON THE SIMPLEX STRAPDOWN NAVIGATION SYSTEM
2 Mar. 1976 21 p
(Contract NAS8-31498)
(NASA-CR-144219; IBM-76-227-002) Avail: NTIS HC $3.50 CSCL 22C

The results of a study of test data taken on the simplex strapdown navigation system were presented. That system consisted of the following components: strapdown platform, altimeter, digital computer, tape recorder, typewriter, and power source. The objective of these tests was to isolate error sources which may cause degradation of the system's accuracy and to recommend appropriate changes to the system test procedures or computer software. The following recommendations were made: (1) addition of a gyro compassing alignment program into the navigation program, (2) addition of line drivers at the signal processor end of the transmission line, (3) need for extensive laboratory testing to determine sensor misalignments, biases, and scale factors, (4) need to stabilize the power source to prevent transients during power transfer, (5) need to isolate and eliminate the source of the large noise inputs. Y.J.A.

N76-20182*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
POSITION ERROR PROPAGATION IN THE SIMPLEX STRAPDOWN NAVIGATION SYSTEM
2 Mar. 1976 26 p refs
(Contract NAS8-31498)
(NASA-CR-144220; IBM-76-227-003) Avail: NTIS HC $4.00 CSCL 22C

The results of an analysis of the effects of deterministic error sources on position error in the simplex strapdown navigation system were documented. Improving the long term accuracy of the system was addressed in two phases: understanding and controlling the error within the system, and defining methods of damping the net system error through the use of an external reference velocity or position. Review of the flight and ground data revealed error containing the Schuler frequency as well as non-repeatable trends. The only unbounded terms are those involving gyro bias and azimuth error coupled with velocity. All forms of Schuler-periodic position error were found to be sufficiently large to require update or damping capability unless the source coefficients can be limited to values less than those used in this analysis for misalignment and gyro and accelerometer bias. The first-order effects of the deterministic error sources were determined with a simple error propagator which provided plots of error time functions in response to various source error values. Author

N76-20183*# Wolf Research and Development Corp., Riverdale, Md.
A GENERAL GEOMETRIC THEORY OF ATTITUDE DETERMINATION FROM DIRECTIONAL SENSING
Bertrand T. Fang 18 Feb. 1976 36 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets in Jun. 1976
(Contract NAS5-20098)
(NASA-CR-144744) Avail: NTIS HC $4.00 CSCL 22C

A general geometric theory of spacecraft attitude determination from external reference direction sensors was presented. Outputs of different sensors are reduced to two kinds of basic directional measurements. Errors in these measurement equations are studied in detail. The partial derivatives of measurements with respect to the spacecraft orbit, the spacecraft attitude, and the error parameters form the basis for all orbit and attitude

determination schemes and error analysis programs and are presented in a series of tables. The question of attitude observability is studied with the introduction of a graphical construction which provides a great deal of physical insight. The result is applied to the attitude observability of the IMP-8 spacecraft. Author

N76-20184*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF THE SQUARE ROOT INFORMATION FILTER FOR NAVIGATION OF THE MARINER 10 SPACECRAFT
C. S. Christensen 15 Jan. 1976 26 p refs
(Contract NAS7-100)
(NASA-CR-146577; JPL-TM-33-757) Avail: NTIS HC $4.00 CSCL 22C

The use is described of a sequential least squares filter in the orbit determination for the Mariner Venus-Mercury (Mariner 10) spacecraft. The orbit determination strategy outlining the use of both the sequential filter and a conventional batch filter is given. Highlighted are the mission events from launch to the first Mercury encounter with emphasis on the sequential filter performance. Advantages to the mission derived from the sequential filter are pointed out. Author

N76-20185# RAND Corp., Santa Monica, Calif.
MEDIA FOR SATELLITE COMMUNICATION
Rudy Bretz Feb. 1975 23 p refs
(AD-A016494; P-5381) Avail: NTIS MF $2.25; HC available from the Rand Corp., Santa Monica, Calif. 90406, $1.50 CSCL 17/2

There are at least 30 separate and distinguishable communication media and multi-media combinations in use, or at least demonstratable today, that can be transmitted between earth and satellite, and back again. In this sense 'medium' includes a means of originating messages, incorporated into programs where appropriate, encoding-transmitting-decoding, and displaying these messages to their intended receivers. If it is a live medium, this all happens in apparent simultaneity. These 30 media are listed in eight classes and discussed. GRA

N76-20186# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
LAGEOS LASER OBSERVATIONS ERROR ANALYSIS
Irwin I. Shapiro 8 Aug. 1975 16 p refs
(Contract F19628-75-C-0058; AF Proj. 8607)
(AD-A017277; AFCRL-TR-75-0488; SR-1) Avail: NTIS CSCL 22/3

Error analyses were performed to estimate the accuracy with which the locations of satellite tracking stations and the motion of the earth's pole will be determinable from laser-ranging observations of the proposed LAGEOS satellite. GRA

N76-20187# Federal Aviation Administration, Washington, D.C.
MEMORANDUM OF UNDERSTANDING ON A JOINT PROGRAM OF EXPERIMENTATION AND EVALUATION USING AN AERONAUTICAL SATELLITE CAPABILITY BETWEEN THE UNITED STATES DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION, THE EUROPEAN SPACE RESEARCH ORGANIZATION (ESRO), AND THE GOVERNMENT OF CANADA International Agreement Report, 1974 - 1984
2 Aug. 1974 70 p
(AD-A010917) Avail: NTIS CSCL 22/2

An international Memorandum of Understanding (MOU) on the JOINT AEROSAT EVALUATION PROGRAM was signed by the FAA Administrator on May 9, 1974 and by the Acting Director-General of ESRO and the Canadian Ambassador to France on August 2, 1974. The MOU package includes the MOU document (18 pp.), related exchange of correspondence (4 pp.), and two integral Annexes (38 and 7 pp. each). The MOU consists of 18 articles which: define objectives and organization of major elements of the program; specify financing policies, satellite deployment, utilization of AEROSAT capability, exchange of test results, and rationale for broadening participation by other Sovereign States; and provide for MOU termination, MOU amendment, procedures for handling disputes and exemption from taxes and customs duties. The exchange of correspondence between FAA and ESRO is concerned with the meaning and scope of the MOU. The major Annex contains the AEROSAT Performance Specification, which assumes the use of L-band between satellites and aircraft. The minor Annex defines the Added Experimental Capability: this is intended to provide FAA with a direct comparison between VHF communication channels and L-band communication channels. GRA

N76-20188# Transportation Systems Center, Cambridge, Mass.
MIDLATITUDE MEASUREMENTS OF L-BAND IONOSPHERIC SCINTILLATION WITH THE ATS-5 SPACECRAFT Final Report, Jun. - Dec. 1974
W. E. Brown, III, G. G. Haroules, and W. I. Thompson, III Sep. 1975 187 p refs Sponsored by DOT
(PB-246286/9; DOT-TSC-OST-75-43) Avail: NTIS HC $7.50 CSCL 17B

Results are presented of L-band signal level measurements taken from the ATS-5 spacecraft operating in the narrow-band frequency translation mode. Weekly, monthly, and seasonal plots of the root-mean-square of the probability density function and the 90th percentile level of the probability distribution function of the received signal amplitude are given. Sample analog recordings of the signal are also presented along with the corresponding computer calculated statistics. Brief equipment descriptions are included along with a description of an automatic data collection platform which was used during some of the measurements. GRA

N76-20189# Federal Communications Commission, Washington, D.C. Research and Standards Div.
THE PRESENT STATUS OF BROADCASTING SATELLITES
A. Das Jul. 1975 54 p refs
(PB-245563/2; FCC/OCE/RS75-06) Avail: NTIS HC $4.50 CSCL 17B

A number of tests regarding broadcasting satellites are discussed with particular reference to the frequency bands to be used and the resulting sharing problems. Experimental health and educational television (TV) broadcasts are currently in progress from the ATS-6 satellite in the 2.50 2.69 GHz frequency band. This frequency band is shared in the United States with the instructional Television Fixed Station (ITFS) and the fixed service (Industrial and public safety). The sharing problem is difficult because many ITFS transmitters use omnidirectional antennas. Transmissions from the ATS-6 satellite will be used in the 860 MHz band for the 1975 Indian instructional TV experiment. An experimental Communications Technology Satellite (CTS) is planned to be launched in 1975. GRA

N76-20190# Boeing Commercial Airplane Co., Seattle, Wash.
US AERONAUTICAL L-BAND SATELLITE TECHNOLOGY TEST PROGRAM Interim Report, 1 Dec. 1974 - 1 Jun. 1975
E. H. Schroeder, R. W. Sutton, A. D. Thompson, C. V. Paulson, and S. G. Wilson Jun. 1975 170 p refs
(Contract DOT-TSC-707)
(AD-A016171; TSC-FAA-75-18) Avail: NTIS CSCL 17/2

The U.S. Aeronautical L-Band satellite test program was performed between September 1974 and April 1975 as part of an international ATS-6 L-Band satellite test program. The U.S. program consisted of both technology and ATC communications demonstration tests. The technology tests were comprised of multipath channel characterization tests; modem tests of voice, data, and ranging; and aircraft antenna tests. Multipath results include delay-Doppler scatter function characteristics and calculations of spectra, spreads and autocorrelations for both over-ocean and CONUS multipath. Comparison of sample results with model prediction is given. Voice modem intelligibility scores, digital data bit error rates and ranging modem performance are presented parametrically as functions of C/N sub 0 and S/I. Experimentally derived gain and multipath rejection performance data are given for the slot-dipoles, phased array, patch, and crossed-slot antennas for various aircraft/satellite geometries. GRA

N76-20303 Lincoln Lab., Mass. Inst. of Tech., Lexington.
IONOSPHERIC LIMITATIONS ON THE ANGULAR ACCURACY OF SATELLITE TRACKING AT VHF OR UHF
J. V. Evans and R. H. Wand *In* AGARD Radio Systems and

the Ionosphere 1976 11 p refs Sponsored in part by US Army (For availability see N76-20302 11-32)

N76-20304 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AMPLITUDE SCINTILLATION OBSERVATIONS AND SYSTEMS APPLICATION
Herbert E. Whitney and Jules Aarons *In* AGARD Radio Systems and the Ionosphere 1976 16 p refs (For availability see N76-20302 11-32)

N76-20305 Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SIMULATION AND IMPLEMENTATION OF A MODULATION SYSTEM FOR OVERCOMING IONOSPHERIC SCINTILLATION FADING
Allen L. Johnson *In* AGARD Radio Systems and the Ionosphere 1976 5 p refs (For availability see N76-20302 11-32)

N76-20306 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
CHANNEL FADING ON AIR MOBILE SATELLITE COMMUNICATIONS LINKS
L. A. Maynard *In* AGARD Radio Systems and the Ionosphere 1976 9 p (For availability see N76-20302 11-32)

N76-20307 General Electric Co., Schenectady, N.Y. Corporate Research and Development.
TRANSIONOSPHERIC EFFECTS ON RANGE MEASUREMENTS AT VHF
Roy E. Anderson *In* AGARD Radio Systems and the Ionosphere 1976 14 p refs (For availability see N76-20302 11-32)

N76-20308 Army Electronics Command, Fort Monmouth, N.J. Communications/Automatic Data Processing Lab.
PLASMASPHERIC CONTRIBUTION TO GROUP-PATH-DELAY OF TRANSIONOSPHERIC SATELLITE NAVIGATION SIGNALS
H. Soicher *In* AGARD Radio Systems and the Ionosphere 1976 15 p refs (For availability see N76-20302 11-32)

N76-20309 General Electric Co., Syracuse, N.Y.
IONOSPHERIC RADAR RANGE ERROR CORRECTION BY THE INCOHERENT SCATTER-FARADY ROTATION TECHNIQUE
George H. Millman and Glenn M. Reinsmith *In* AGARD Radio Systems and the Ionosphere 1976 13 p refs Sponsored by RADC (For availability see N76-20302 11-32)

N76-20310 National Observatory of Athens (Greece). Ionospheric Inst.
LONG RANGE VHF TRANSEQUATORIAL FOR THE EUROPEAN-AFRICAN PATH, A REVIEW OF TIME DELAY MEASUREMENTS
Michael Anastassiadis and George Stefanou *In* AGARD Radio Systems and the Ionosphere 1976 22 p (For availability see N76-20302 11-32)

N76-20311 Appleton Lab., Slough (England).
A NEW COMPUTER-BASED METHOD OF HF SKY-WAVE SIGNAL PREDICTION USING VERTICAL-INCIDENCE IONOSONDE MEASUREMENTS
P. A. Bradley *In* AGARD Radio Systems and the Ionosphere 1976 16 p refs (For availability see N76-20302 11-32)

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-20191*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE LIFT-OFF DYNAMIC MODEL
D. Christian Mar. 1976 39 p refs
(NASA-TM-X-64993) Avail: NTIS HC $4.00 CSCL 22B

Previously developed dynamic models for the calculation of lift-off dynamic response of the space shuttle vehicle can handle only response of the vehicle with eight holddown arms attached or with all holddown arms detached. The new model developed in the referenced report takes into account the transition period between holddown and lift-off by giving the model the ability to vary holddown point separation as a function of vehicle flexible body and rigid body motion. This report documents a study made to verify the new model's capability to simulate vehicle response at lift-off. To do this, a finite element model of the skirt is made and coupled to the free-free modes of the vehicle and cantilevered modes calculated and compared with the previously developed model. Results indicate that the new model will be able to predict accurate vehicle loads. Author

N76-20192*# Grumman Aerospace Corp., Bethpage, N.Y.
MODAL ANALYSIS AND DYNAMIC STRESSES FOR ACOUSTICALLY EXCITED SHUTTLE INSULATION TILES
Irving U. Ojalvo and Patricia L. Ogilvie [1975] 171 p refs (Contract NAS1-10635)
(NASA-CR-144958) Avail: NTIS HC $6.75 CSCL 22B

Improvements and extensions to the RESIST computer program developed for determining the normalized modal stress response of shuttle insulation tiles are described. The new version of RESIST can accommodate primary structure panels with closed-cell stringers, in addition to the capability for treating open-cell stringers. In addition, the present version of RESIST numerically solves vibration problems several times faster than its predecessor. A new digital computer program, titled ARREST (Acoustic Response of Reusable Shuttle Tiles) is also described. Starting with modal information contained on output tapes from RESIST computer runs, ARREST determines RMS stresses, deflections and accelerations of shuttle panels with reusable surface insulation tiles. Both programs are applicable to stringer stiffened structural panels with or without reusable surface insulation titles. Author

N76-20193*# Martin Marietta Corp., Denver, Colo.
PAYLOAD/ORBITER CONTAMINATION CONTROL REQUIREMENT STUDY: COMPUTER INTERFACE Interim Report
L. E. Bareiss, V. W. Hooper, and E. B. Ress 29 Feb. 1976 28 p
(Contract NAS8-31574)
(NASA-CR-144232; MCR-76-165) Avail: NTIS HC $4.00 CSCL 22B

The MSFC computer facilities, and future plans for them are described relative to characteristics of the various computers as to availability and suitability for processing the contamination program. A listing of the CDC 6000 series and UNIVAC 1108 characteristics is presented so that programming requirements can be compared directly and differences noted. Author

N76-20194*# Martin Marietta Corp., Denver, Colo.
ANALYTICAL TRADE STUDY OF THE STS PAYLOAD ENVIRONMENT
W. P. Rader, Stan Barrett, John Raratono, and Ken Payne Mar. 1976 219 p refs
(Contract NAS8-31535)
(NASA-CR-144233; MCR-76-166) Avail: NTIS HC $7.75 CSCL 22B

The current predicted acoustic environment for the shuttle orbiter payload bay will produce random vibration environments for payload components and subsystems which potentially will result in design, weight and cost penalties if means of protecting the payloads are not developed. Results are presented of a study to develop, through design and cost effectiveness trade studies, conceptual noise suppression device designs for space shuttle payloads. The impact of noise suppression on environmental levels and associated test costs, and on test philosophy for the various payload classes is considered with the ultimate goal of reducing

payload test costs. Conclusions and recommendations are presented. Author

N76-20195*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSFORMER DESIGN TRADEOFFS
W. T. McLyman 1 Apr. 1976 92 p refs
(Contract NAS7-100)
(NASA-CR-146554; JPL-TM-33-767) Avail: NTIS HC $5.00 CSCL 22B

Material was presented to assist transformer designers in the transition from long-used English units to the less familiar metric equivalents. A coordination between the area product numbers ap (product of window and core cross-section areas) and current density J was developed for a given regulation and temperature rise. Straight-line relationships for Ap and Volume, Ap and surface area At and, Ap and weight were developed. These relationships can now be used as new tools to simplify and standardize the process of transformer design. They also made it possible to design transformers of small bulk and volume or to optimize efficiency. Author

N76-20196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SUMMARY OF THE SKYLAB CREW/VEHICLE DISTURBANCES EXPERIMENT T-013
Bruce A. Conway and T. C. Hendricks Washington Mar. 1976 241 p refs
(NASA-TN-D-8128; L-10415) Avail: NTIS HC $8.00 CSCL 22C

A manned space flight experiment (designated experiment T-013) to assess the characteristics of astronaut crew-motion disturbances was conducted on the second manned Skylab mission. A brief description of the experiment hardware utilized is given, and a comprehensive discussion of the experiment data reduction and analysis is presented. Data obtained from a force-measuring system, an astronaut limb-motion measuring system, motion-picture film, and the Skylab attitude and pointing control system is described. Results show that astronaut crew members can produce significant disturbance inputs to a spacecraft's attitude control system. Total forces of up to 400 N were exerted during vigorous soaring activities, whereas "restrained" motions by the experiment subject generated total forces of up to 300 N. A discussion of potential applications of the experiment results is given and appendixes provide additional detail with respect to experiment operations and results. Author

N76-20197# Polytechnical Univ. of Madrid (Spain). School of Aeronautics.
SPACECRAFT THERMAL CONTROL DESIGN DATA, VOLUME 1
May 1975 674 p refs Prepared jointly with Dornier System 2 Vol.
(Contract ESTEC-2124/73-AK)
(ESA-CR(P)-753-Vol-1) Avail: NTIS HC $16.25

Properties and characteristics in the following areas are presented in the form of tables and graphs: view factors; spacecraft surface temperatures; spacecraft construction materials; thermal conductance of joints; and thermal control coatings. For individual titles, see N76-20198 through N76-20202.

N76-20198 Polytechnical Univ. of Madrid (Spain).
VIEW FACTORS
In its Spacecraft Thermal Control Design Data, Vol. 1 May 1975 215 p refs (For availability see N76-20197 11-18)

View and conductive shape factors for a variety of diffuse and specular surfaces are given including infinitesimal to finite, finite to finite, plane, cylindrical, conical, spherical and various combinations of these. ESA

N76-20199 Polytechnical Univ. of Madrid (Spain).
SPACECRAFT SURFACE TEMPERATURE
In its Spacecraft Thermal Control Design Data, Vol. 1 May 1975 154 p refs (For availability see N76-20197 11-18)

The surface temperature of spacecraft as a result of solar and albedo radiation is calculated for a variety of surface shapes and orientations including spheres, conical, pyramidal and cylindrical bodies and prisms. Data are presented in the form of graphs. ESA

N76-20200 Polytechnical Univ. of Madrid (Spain).
STRUCTURAL MATERIALS
In its Spacecraft Thermal Control Design Data, Vol. 1 May 1975 149 p refs (For availability see N76-20197 11-18)

Chemical, physical and mechanical properties of light and superalloys used in spacecraft construction are tabulated. Alloys include aluminum, magnesium, titanium, nickel and iron. Forming and metal working techniques are included. ESA

N76-20201 Polytechnical Univ. of Madrid (Spain).
THERMAL JOINT CONDUCTANCE
In its Spacecraft Thermal Control Design Data, Vol. 1 May 1975 52 p refs (For availability see N76-20197 11-18)

Data on the thermal conductance of metal joints is presented for the following: bare metallic joints; metal foils between similar metals; metal oxide powder between similar metals; porous metallic materials between similar metals; insulating spacers, thermal greases and elastomeric materials between similar metals. ESA

N76-20202 Polytechnical Univ. of Madrid (Spain).
COATINGS
In its Spacecraft Thermal Control Design Data, Vol. 1 May 1975 102 p refs (For availability see N76-20197 11-18)

Surface and physical properties of thermal control coatings, solar reflectors, paints, and adhesive tapes are tabulated. ESA

N76-20203# Polytechnical Univ. of Madrid (Spain). School of Aeronautics.
SPACECRAFT THERMAL CONTROL DESIGN DATA, VOLUME 2
May 1975 730 p refs Prepared jointly with Dornier System 2 Vol.
(Contract ESTEC-2124/73-AK)
(ESA-CR(P)-754-Vol-2) Avail: NTIS HC $18.75

Properties and characteristics in the following areas are presented in the form of tables and graphs: insulators (foams, radiation shielding, multilayer); heat pipes, fins and radiators; louvers and fluid loops. For individual titles, see N76-20204 through N76-20206.

N76-20204 Polytechnical Univ. of Madrid (Spain).
INSULATIONS
In its Spacecraft Thermal Control Design Data, Vol. 2 May 1975 272 p refs (For availability see N76-20203 11-18)

Thermal and mechanical properties of foams, fibrons insulations (blankets, felts), multilayer insulations, radiation shields, spacers and complete systems suitable for spacecraft structures are tabulated. ESA

N76-20205 Polytechnical Univ. of Madrid (Spain).
PASSIVE THERMAL CONTROL TECHNIQUES
In its Spacecraft Thermal Control Design Data, Vol. 2 May 1975 219 p refs (For availability see N76-20203 11-18)

The characteristics and properties of heat pipes, radiators, fins and phase-change materials suitable for spacecraft are tabulated. ESA

N76-20206 Polytechnical Univ. of Madrid (Spain).
ACTIVE THERMAL CONTROL TECHNIQUES
In its Spacecraft Thermal Control Design Data, Vol. 2 May 1975 235 p refs (For availability see N76-20203 11-18)

Properties and characteristics of louvers, actuators, bellows and fluid loops as techniques for spacecraft thermal control are tabulated. ESA

N76-20207# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Flugbahnen.
MODELING OF THE POSITIONING PROCEDURE STARTING FROM PRIMARY ORBIT FOR THE GEOSTATIONARY SATELLITE SYMPHONIE
Ernst-Dieter Dickmanns, Norman Engersbach, and Richard Schwertassek 23 Oct. 1975 71 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-70) Avail: NTIS HC $4.50; DFVLR, Cologne DM 25,20

For the computation of the minimum fuel rendezvous of

Symphonie with its geostationary target point, a modified gradient method was used. The corresponding cost function and mission constraints were modeled. Based on the model, a highly flexible software package was developed which can handle a wide range of problems. In the Symphonie project the software was used for the mission analysis and after launch in two operational modes: one as a subroutine of a stochastic optimization program to compute the apogee impulse and the other within a second program to determine the orbit corrections after apogee impulse was executed. Author (ESA)

N76-20208# Stuttgart Univ. (West Germany). Dept. of Energy Conversion and Heat Transfer.

DESIGN, DEVELOPMENT AND SPACE QUALIFICATION OF A PROTOTYPE PHASE CHANGE MATERIAL DEVICE Final Report

A. Abhat Oct. 1975 118 p refs
(Contract ESTEC-2331/74-AK)
(ESA-CR(P)-757) Avail: NTIS HC $5.50

The small prototype PCM (Phase Change Material) device designed for spacecraft thermal control and having a latent storage capacity of 100 watt-hours, is a hermetically sealed unit made from aluminum alloy, filled with octadecane serving as the PCM and uses aluminum honeycomb structure as the filler material. The overall weight of the device is approximately 2,400 gm. A thermal network model was successfully developed to design the PCM device and predict its thermal performance under different heat load conditions. Experiments were done following construction of the prototype PCM device to obtain actual performance data and to prove its ability to withstand the space qualification procedures. Experimental data indicated the device to be well-suited for the desired space applications. Comparison between theory and experiments showed good agreement. Author (ESA)

N76-20209# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Flugbahnen.

MINIMIZATION OF FUNCTIONS WITH DISCONTINUOUS DERIVATIVES AND NONLINEAR CONSTRAINTS

Ernst-Dieter Dickmanns, Norman Engersbach, and Richard Schwertassek 23 Oct. 1975 69 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-69) Avail: NTIS HC $4.50; DFVLR, Cologne DM 25,90

The cost function of the minimum fuel positioning procedure of the geo-stationary Symphonie satellite is not differentiable along certain known curves. The constraints of the resulting parameter optimization problem are of the equality and inequality types. A modification is given of the Davidon-Fletcher-Powell (DFP) method to handle those nonanalytical functions together with inequality constraints. Numerical results for the solution of problems specific to Symphonie using the modified DFP method are given as examples. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-20210+ Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France). Service Systemes et Electronique.

TECHNICAL ACCEPTANCE OF A MODIFIED ANGULAR POSITION INDICATOR (API) [RECEPTION TECHNIQUE D'UN INDICATEUR DE POSITION ANGULAIRE MODIFIE (IPA)]

Levesque and Rocher 30 Jun. 1975 25 p In FRENCH
(LRBA-E-310-NT-6/SYE) Avail: NTIS HC $3.50

The acceptance tests carried out on a portable Kearfott angular position indicator to be used on an inertial platform are described. They include checkout of the cabling system, the 6 volt/26 volt/115 volt (400 or 512 Hz) amplifier, the insulating amplifiers, and the angular indicator using a bipolar resolver, as well as the attitude angle control of an inertial platform using the angular position indicator. ESA

N76-20211*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

GEOS-C C-BAND TRANSPONDER PRELAUNCH CALIBRATION AND TEST DATA

A. R. Selser Feb. 1976 55 p refs
(NASA-TM-X-69361) Avail: NTIS HC $.50 CSCL 17B

The delay characteristics and spacecraft telemetry housekeeping data for the GEOS-C C-Band transponders are presented. The data are presented in graphical form to provide a convenient method for computing radar range measurement corrections as a function of signal strength at the transponder and spacecraft environment. The data are also presented in tabular form along with the mathematical models used to derive the curves. Also included are a list of the operating characteristics of each transponder and a description of the calibration test equipment set-up. Author

N76-20212*# Old Dominion Univ. Research Foundation, Norfolk, Va.

LINEAR AND NONLINEAR ANALYSIS OF ORBITAL TELESCOPE/SPACE SHUTTLE DYNAMICS AND CONTROL Semiannual Progress Report, 15 Sep. 1975 - 15 Mar. 1976

A. S. Roberts, Jr. and S. M. Joshi (Old Dominion Univ.) Mar. 1976 39 p refs
(Grant NsG-1241)
(NASA-CR-146571; TR-76-T3) Avail: NTIS HC $4.00 CSCL 22B

Work completed on the design and study of an annular suspension and pointing (ASP) system for the space shuttle was presented. This system makes use of a magnetically suspended vernier pointing assembly. The following objectives were pursued in this study: (1) development of a detailed mathematical model of the Space Shuttle/ASP system, (2) design of control laws in order to obtain the desired pointing performance, and (3) prediction of the statistical pointing accuracies in the presence of stochastic disturbances such as crew-motion, and sensor and actuator noise. The first two of these objectives are documented in this report. Author

N76-20213# Technisch Physisch Dienst TNO-TH, Delft (Netherlands). Afdeling Optics.

BREADBOARDING OF A COMBINED SUN/EARTH ALBEDO SENSOR Final Report

C. Smorenburg and H. VanAgthoven 26 Sep. 1975 93 p refs Sponsored by ESA
(Rept-417.279; ESA-CR(P)-779) Avail: NTIS HC $5.00

The design, manufacture and test of a combined sun/earth albedo sensor is described. After the zero-design of the single and double reflective configuration the single reflective system was chosen and elaborated to a breadboard model. The manufacturing of the optical and mechanical parts of the sensor was a rather accurate, but not excessively difficult job. The most critical phase was the manufacturing of the small exit slit exactly parallel with the focal line of the cylindrical mirror. Any misalignment would introduce directly a considerable decrease in optical performance. The final adjustment of the sensor was performed without unexpected difficulties. The final testing of the sensor gave a good agreement of its performance with the expectations, especially concerning the image quality and straylight. Also the thermal behavior was very satisfactory. Only the total efficiency is lower than expected. A possible explanation may be that the silver reflecting coating has a lower efficiency than predicted, the reason of which still is not clear.

Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N76-20214*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLID ROCKET MOTOR NOZZLES Space Vehicle design criteria (chemical propulsion)
Russell A. Ellis (Thiokol Chemical Corp., Wasatch Div.) and Russell B. Keller, Jr., ed. Jun. 1975 140 p refs
(NASA-SP-8115) Avail: NTIS HC $6.00 CSCL 21H

The steps in the nozzle design process are examined. The nozzle designer's role in defining design requirements and constraints is included along with discussions of each of the three basic phases of the nozzle design process itself: (1) aerodynamic design, in which the gas-contacting surfaces are configured to produce the required performance within the envelope limits; (2) thermal design, in which termal liners and thermal insulators are selected and configured to maintain the surfaces as closely as practical against effects of erosion and to limit the structure temperature to acceptable levels; and (3) structural design, in which materials are selected and configured to support the thermal components and to sustain the predicted loads. Analytical techniques that are used to establish thermal and structural design integrity and to predict nozzle performance are discussed along with methods for nozzle quality assurance. Emphasis is placed on nozzle design and materials for modern high-temperature aluminized propellants. Recurring nozzle design problems of graphite cracking and ejection, differential erosion at material interfaces, lack of sufficient proven nondestructive testing (NDT) techniques, the uncertainty of adhesive bonding, and inadequate definition of material properties, particularly at high temperatures are considered. Author

N76-20215*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL COMBUSTOR Patent Application
Cecil J. Marek, inventor (to NASA) Filed 31 Mar. 1976 11 p
(NASA-Case-LEW-12137-1; US-Patent-Appl-SN-672210) Avail: NTIS HC $3.50 CSCL 21H

A fuel combustor comprised of a chamber with air and fuel inlets and a combination gas outlet is described. The fuel is supplied to a vaporization zone and fuel and air are mixed in a pair of mixing chambers each exemplified by a swirl can. The resultant mixture is directed into a combustion zone within the combustor. Combustion products are exhausted, for example, into a turbine inlet. By use of the heat pipe means some of the heat of combustion is carried back upstream into the swirl cans, to vaporize the fuel as it enters the vaporization zone in the swirl can, thereby improving vaporization and fuel mixing. Fewer pollutants are formed and complete combustion is assisted because of the improved fuel vaporization and better mixing.
NASA

N76-20216# Gulf General Atomic, San Diego, Calif.
RADIOISOTOPE SPACE POWER GENERATOR Annual Report, 1 Jul. 1973 - 30 Jun. 1974
N. B. Elsner and J. Chin 15 Jul. 1975 89 p refs
(Contract AT(04-3)-943)
(GA-A-13426) Avail: NTIS HC $7.50

During the Isotec Technology Program in FY 1974, fabrication of the first ring converter segment was completed. In subsequent performance testing at Jet Propulsion Laboratories it demonstrated good agreement with the expected performance. The segment has accumulated over 7,000 hours at a T/sub H/of 450 C and the degradation rate over the last 5,000 hours has been 0.1 percent. In the area of SiGe technology, continued compatibility tests between candidate insulation materials and SiGe, SiMo, and Si3N4 were conducted. The Si3N4 in all cases continued to perform satisfactorily as a high temperature insulator. Low temperature Si3N4 coating development on SiGe thermocouples was performed by ion plating. While the ion plating process was successful in coating a whole couple, the Si3N4 deposited was silicon rich. Author (NSA)

N76-20217# Los Alamos Scientific Lab., N.Mex.
SAFETY TEST NO. S-6, LAUNCH PAD ABORT SEQUENTIAL TEST PHASE 2: SOLID PROPELLANT FIRE
E. C. Snow Aug. 1975 20 p refs
(Contract W-7405-eng-36)
(LA-6034-MS) Avail: NTIS HC $4.00

A series of tests were performed to evaluate the nuclear safety capability of the multi-hundred watt (MHW) radioisotope thermoelectric generator (RTG) to be used to supply power for the satellite. One such safety is test no. S-6, Launch Pad Abort Sequential Test. The objective of this test was to subject the RTG and its components to the sequential environments characteristic of a catastrophic launch pad accident to evaluate their capability to contain the Pu(-238)O2 fuel. The procedures and results of Phase II of Test S-6, solid propellant fire are presented. In this phase of the test, a simulant fuel sphere assembly and a mockup of a damaged heat source assembly were subjected to single proximity solid propellant fires of approximately 10-min duration. Steel was introduced into both tests to simulate the effects of launch pad debris and the solid rocket motor casing that might be present in the fire zone. NSA

N76-20218# European Space Research and Technology Center, Noordwijk (Netherlands).
INVESTIGATION OF THE TECHNOLOGY AND PERFORMANCE OF LITHIUM DOPED SOLAR CELLS
J. C. Larue, A. Atzei, and G. Schmalhofer (Siemens AG, Munich) 1975 21 p refs
Avail: NTIS HC $3.50

The technological problems in the manufacture of lithium doped silicon solar cells was investigated and their performance was evaluated. Nine different cell types were prepared using crucible grown, float zone and WASO (Wacker Chemie) silicon as a base material, several base resistivities, and two different lithium diffusion schedules. The power output of the best cells was approximately 12% higher than that of present European cells after irradiation followed by annealing at 55 C.
Author (ESA)

N76-20219# RFE Raumfahrtelektronik G.m.b.H. and Co., Goeggenhofen (West Germany).
ARRAY EXPERIMENT ELECTRONICS (AEE) Final Report
W. Ansorge and H. G. Pischel Apr. 1975 25 p
(Contract ESTEC-1982/73-MD)
(ESA-CR(P)-767) Avail: NTIS HC $3.50

The planning and implementation phases of the AEE project are summarized. The AEE will be used onboard the Canadian Technology Satellite to monitor experimental solar cells and temperature sensors installed on the solar blanket. A comparison is made between the most important specification requirements and the achieved build standard of the experiment. A survey of software established is given in a drawing family tree and a documentation list. ESA

N76-20220# Hawker Siddeley Dynamics Ltd., Stevenage (England). Space Div.
HYBRID SOLAR ARRAY CONFIGURATION
B. Collins, comp. Nov. 1975 298 p refs
(Contract ESTEC-2416/75-HP)
(HSD-TP-7557; ESA-CR(P)-776) Avail: NTIS HC $9.25

The performance of three types of hybrid solar array on various geostationary three axis stabilized spacecraft is identified and compared with the performance of an Ultra Light Panel (ULP) array. Performance criteria considered are spacecraft and launch vehicle interfaces, mission constraints, and power requirements. Single and double roll-up solar arrays are first converted into hybrids, then, together with the hybrid fold-up and semi-rigid ULP arrays, configurations are derived for various power levels of interest. These configurations are then analyzed in terms of mass properties, dynamic characteristics, disturbance torques, required spacecraft control system, structural impact, thermal impact, magnetic effect, and system level mass penalties. The performance of the hybrid and ULP arrays is compared.ESA

N76-20221# Missouri Univ., Rolla. Dept. of Physics.
KINETIC REACTION COEFFICIENTS IN ROCKET EXHAUST PLUMES Interim Report, 1 Mar. 1974 - 31 Jun. 1975
William R. Snow, Laird D. Schearer, Kaare J. Nygaard, and R. J. Corbin Aug. 1975 34 p refs
(Contract AF-AFOSR-2672-74; AF Proj. 9750)
(AD-A017640; AFOSR-75-1550TR) Avail: NTIS CSCL 07/4

During the first year of the program, the cross section photoionization of excited potassium atoms has been measured from threshold to 2,500A. A drift tube apparatus with a quadrupole mass spectrometer for ion identification has been constructed to study dissociative attachment of HCl. The primary ion, Cl(-), has been found to form molecular negative ions identified as HClCl(-), (HCl) 2Cl(-), and the impurity ion H2O, Cl(-). For drift tube conditions near the threshold for dissociative attachment for HCl, the molecular negative ions are most abundant; at higher drift tube energies, the atomic negative ion dominates. A xenon-ion laser has been constructed and its power level optimized so that a frequency doubling crystal can be used to make a useful source of ionization for future recombination measurements. Cross sections for the formation of Cl(+) from Cl2 and HCl by electron impact have been measured from threshold to 100eV. GRA

N76-20222# Ultrasystems, Inc., Irvine, Calif.
A COMPUTER PROGRAM FOR THE PREDICTION OF SOLID PROPELLANT ROCKET MOTOR PERFORMANCE, VOLUME 1 Final Report
D. E. Coats, J. N. Levine, N. S. Cohen, G. R. Nickerson, T. J. Tyson, D. P. Harry, III, and C. F. Price Jul. 1975 135 p refs
(Contract F04611-73-C-0038; AF Proj. 3059)
(AD-A015140; AFRPL-TR-75-36-Vol-1) Avail: NTIS CSCL 21/8

A flexible, modular, fully automated, solid rocket motor performance prediction program has been developed. The program, which has been given the acronym SPP is based on six pre-existing computer codes. These codes have been integrated and modified, as required. To supplement the theory, where necessary, and to increase the flexibility of the program, a number of existing and newly developed semi-empirical correlations were incorporated into the program. The program has a general three-dimensional grain design capability, coupled to a one-dimensional ballistics analysis. The deviations from ideal performance are computed as a series of independent efficiencies. The program currently treats the following losses: two-dimensional/two-phase (coupled), nozzle erosion, kinetics, boundary layer, combustion efficiency, submergence. The program predicts average delivered performance, as well as mass flow, pressure, thrust, impulse, and specific impulse as functions of time and trajectory. GRA

N76-20223# Ultrasystems, Inc., Irvine, Calif.
A COMPUTER PROGRAM FOR THE PREDICTION OF SOLID PROPELLANT ROCKET MOTOR PERFORMANCE, VOLUME 2 Final Report
D. E. Coats, J. N. Levine, N. S. Cohen, G. R. Nickerson, T. J. Tyson, D. P. Harry, III, and C. F. Price Jul. 1975 271 p refs
(Contract F04611-73-C-0038; AF Proj. 3059)
(AD-A015141; AFRPL-TR-75-36-Vol-2) Avail: NTIS CSCL 21/8

This is Volume 2 of a three-part report which describes a computer program for the prediction of Solid Propellant Rocket Motor Performance. The computer program described is referred to as the SPP program. Volume I of this report describes the engineering analysis which was used in developing this computer program. Volume 2 of this report is a programming document of the computer program which was developed under this contract. It includes a subroutine-by subroutine description of all of the elements of the SPP program. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-20224 Massachusetts Univ., Amherst.
CHARACTERISTICS OF DUAL IMMOBILIZED ENZYMIC SYSTEMS OF GLUCOSE OXIDASE AND CATALASE Ph.D. Thesis
James C. Bouin 1975 192 p
Avail: Univ. Microfilms Order No. 76-5274

Immobilized enzyme catalysts were constructed with glucose oxidase and catalase by covalent binding with glutaraldehyde to nickel-impregnated silica alumina particles treated with gamma-aminopropyltriethoxysilane. The enzymes were studied when both enzymes were immobilized onto the same catalyst support particles (dual system), when the catalyst was composed of a mixture of two singly immobilized derivatives (mixed system), and when in solution (soluble system). Varying the concentration of enzyme(s) in the immobilization solution was the most important factor in controlling the activities of enzyme derivatives. The efficiency of the second enzyme in the reaction sequence (E2) in dual immobilized catalysts was found to be dependent on the ratio and the level of enzymic activities of the derivatives. When comparing the efficiency of E2 in dual, mixed and soluble systems when the enzymes were adjusted to the same first order rate constants, the efficiency of E2 in the dual system was superior to those of the others. Dissert. Abstr.

N76-20225# European Space Research and Technology Center, Noordwijk (Netherlands).
ESA's POLICY FOR MATERIALS ACTIVITIES
J. Dauphin Paris ESA Oct. 1975 22 p refs In FRENCH; ENGLISH summary
(ESA-TN-133-ESTEC) Avail: NTIS HC $3.50

Reasons for materials activities are analyzed and the policy followed by ESA in this area is discussed. Three basic aspects are considered: testing, documentation, and qualification. In each case, the type of service provided by Materials Section, ESTEC, to the various space projects is described. ESA

N76-20226# Picatinny Arsenal, Dover, N.J.
STUDY OF THE REACTION OF CELLULOSE NITRATE WITH ISOCYANATES
Jack Bobinski Mar. 1975 40 p refs
(DA Proj. 1T0-61102-A-32C)
(AD-A009506; PA-TR-4718) Avail: NTIS CSCL 07/3

Cellulose nitrate phenyl carbamate was synthesized and characterized. It was discovered that it is not necessary to conduct this reaction under strictly anhydrous conditions. The reaction is aided by the excess of phenyl isocyanate, elevated temperatures, suitable solvents and a low degree of substitution of nitrocellulose. Denitration occurs as the reaction progresses however, the formation of the carbamate substituent is not directly related to the loss of the nitrate groups. GRA

N76-20227# Drexel Univ., Philadelphia, Pa.
MECHANISMS OF THERMAL DECOMPOSITION OF STORED MATERIALS Quarterly Report, 1 Jan. - 31 Mar. 1974
Louis L. Pytlewski Oct. 1974 19 p refs
(Contract DAAA15-74-C-0113)
(AD-A009762; ED-CR-74029; QR-1) Avail: NTIS CSCL 07/3

The report discusses the conditions and mechanisms of thermal decomposition of XXCC-3 a clothing impregnant used to protect military personnel from vesicant gases. The XXCC-3 is a mixture of ZnO and Symdichlorobis (2, 4, 6 trichlorophenyl) urea. Thermal analysis, spectra, and solubility studies are discussed in light of the reported spontaneous combustion of kits containing this compound. Author (GRA)

N76-20228# Ohio State Univ. Research Foundation, Columbus.
RADIOPROTECTIVE AGENTS: STEREOCHEMICAL STUDIES Final Comprehensive Report, 1 Dec. 1971 - 30 Nov. 1974
Donald T. Witiak Dec. 1974 46 p refs
(Contract DADA17-72-G-2073)
(AD-A017445; OSURF-3363-A1) Avail: NTIS CSCL 07/3

For purposes of studying stereostructure-activity relationships at the molecular, cellular and animal levels and probing the mechanism of 2-mercaptoethylamine (MEA) radioprotection, we synthesized several conformationally constrained cyclobutyl

analogs. The comparative radioprotective properties for MEA, cis- and trans-2-mercaptocyclobutylamine (2), cis- and trans-2-mercaptocyclobutylmethylamine(3), and trans-2-mercaptomethylcyclobutylamine(4) are discussed in terms of their ability to chemically reduce transient free radicals, the formation of single strand breaks in DNA, and protect Chinese hamster cells (in vitro) and mice against the lethal effects of ionizing radiation. The results are interpreted in light of current proposed mechanisms of action for MEA. No correlation exists between ability of these analogs to enhance mice survival times and their ability to protect against the induction of DNA single strand breaks and the inactivation of proliferative capacity of hamster cells growing in vitro. Analysis of two isomers (cis- and trans-3) on the repair of single strand breaks showed both isomers only marginally influenced the rate and did not influence the extent of single strand break rejoining. The results are consistent with a mode of action involving chemical repair of transient radicals and protection against DNA and critical enzymatic sites. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N76-20229+ METRAVIB, Lyon (France).
KINETIC ENERGY ABSORPTION OF SHOCKS BY COMPOSITE MATERIALS Final Report [UTILISATION DES MATERIAUX COMPOSITES POUR L'ABSORPTION D'ENERGIE CINETHIQUE LORS DES CHOCS]
B. Duperray Mar. 1975 45 p refs In FRENCH
(Contract DGRST-73-7-1870)
Avail: NTIS HC $4.00

A bibliographic study of high diffusion composite materials is presented with regard to static and dynamic behavior under shock. The dynamic behavior under vibration conditions was investigated by considering the time evolution of the dynamic modulus of elasticity and damping in reinforced plastics. A list of laboratories in France dealing with composite materials is appended. ESA

N76-20230*# Avco Corp., Lowell, Mass. Systems Div.
IMPROVING THE TOUGHNESS OF REFRACTORY COMPOUNDS Final Report
Thomas Vasilos and Rowland M. Cannon, Jr. Nov. 1975 62 p refs
(Contract NAS3-17768)
(NASA-CR-134813; AVSD-0108-76-RR) Avail: NTIS HC $4.50 CSCL 11D

Composition and processing studies were conducted on silicon nitride and silicon carbide materials. Charpy mode impact testing to 2415 F established the effectiveness of higher purity silicon nitride powder sources in reducing the scatter of measurements and in improving short time bend strengths as well as bend stress rupture properties. Stabilized zirconia additions in particular were observed to dramatically enhance low and high temperature bend strengths and stress rupture properties for all grades of silicon nitride powder. Silicon carbide samples showed relatively poor impact resistance, although the maxima in stress rupture behavior was exhibited by this material. Author

N76-20231# Martin Marietta Aerospace, Orlando, Fla.
DEVELOPMENT AND EVALUATION OF REFRACTORY MATERIALS FOR ADVANCED INTERCEPTOR AIR VANES Final Report, 29 May 1974 - 28 Feb. 1975
Archie Ossin and David P. Lippy Sep. 1975 112 p refs
(Contract DAAG46-74-C-0130; DA Proj. 1W1-62113-A-061)
(AD-A017091; OR-13672; AMMRC-CTR-75-16) Avail: NTIS CSCL 15/3

This document reports the results of a nine-month research study entitled Development and Evaluation of Refractory Materials for Advanced Interceptor Air Vanes. The overall objective of this program was to define the recession performance of three tungsten alloy materials over the entire advanced interceptor flight regime. The materials evaluated were (1) tungsten hafnium carbide (arc cast), (2) thoriated tungsten (powder metallurgy), and (3) tungsten-copper (copper infiltrated). This selection was based on the results of previous work accomplished under AMMRC Contract DAAG46-74-C-0051. The recession performance evaluation of these materials includes both experimental and analytical work. Recession data, experimentally obtained at the 5 MW plasma arc at Martin Marietta's Denver Division and at the 50 MW plasma arc at Wright-Patterson Air Force Base, have been incorporated into an analytical model. This model has been used to define interceptor flight regimes for which refractory air vanes are applicable. The results of this program show that, at air vane leading edge stagnation line pressures of interest, the tungsten hafnium carbide (arc cast) material has superior performance compared to the other materials tested. Analyses, based upon these data, show that a tungsten hafnium carbide (arc cast) air vane leading edge can perform with an acceptable amount of surface recession in the 15,000 ft/s burnout velocity regime for an advanced antiballistic missile.
Author (GRA)

N76-20232# Southwest Research Inst., San Antonio, Tex.
DESIGN OF A TEST MACHINE FOR BIAXIAL TESTING OF COMPOSITE-LAMINATE CYLINDERS Final Report, May 1974 - Apr. 1975
U. S. Lindholm, A. Nagy, L. M. Yeakley, and W. L. Ko Wright-Patterson AFB, Ohio AFFDL Jul. 1975 82 p refs
(Contract F33616-74-C-0043; AF Proj. 1467)
(AD-A016961; AFFDL-TR-75-83) Avail: NTIS CSCL 14/2

A design is presented for a facility to test composite laminate tubes under generalized plane stress loading conditions. The system is designed around multiple closed-loop servo-controlled hydraulic load actuators to provide independent, programmable axial, circumferential and torsional stress to tubular specimens. The unique feature of the design is an actively controlled, hydraulic, collet-type grip. The grip is designed to provide radial displacement of the collet to compensate for deformation in the specimen during loading. This radial compensation is shown to significantly reduce the grip induced constraint stresses which previously have been a serious problem in the testing of composite tubes. GRA

N76-20233# Newcastle-upon-Tyne Univ. (England). Dept. of Metallurgy and Engineering Materials.
DYNAMIC FRACTURE TOUGHNESS MEASUREMENT Final Technical Report, May 1974 - Apr. 1975
J. Congleton and B. K. Denton Jul. 1975 84 p refs
(Grant DA-ERO-124-74-G0053)
(AD-A016933) Avail: NTIS CSCL 11/2

An improved crack velocity monitoring procedure able to cope with irregular crack initiation and crack acceleration in ceramics has been developed and used to obtain KId measurements for silicon nitride, polycrystalline alumina and magnesia. The system allowed extended recording times at fast sweep rates for open-camera single shot oscilloscope work. Velocity data was obtained for three point bend tests on PMMA using surface resistance grids to monitor crack growth and an auto-resistance technique was used for velocity measurements during bend tests on tool steels. For the latter, the data was interpreted using an iterative procedure based on an empirical estimate of the functional dependence of the dynamic potential output. Consistent and reproducible data was obtained using auto-resistive crack length measurements for fast fracture in bending, tension and combined impact-tension tests but the interpretation of the resulting data requires further clarification.
GRA

N76-20234# Cambridge Univ. (England). Dept. of Engineering.
IMPROVING THE IMPACT AND FRACTURE RESISTANCE OF FIBROUS COMPOSITES Final Technical Report, Aug. 1974 - Aug. 1975
Peter W. R. Beaumont and Vivien Martin Aug. 1975 44 p refs
(Grant DA-ERO-75-G-009; DA Proj. 1T1-61102-B-35E)
(AD-A016959; CUED/C-Mat/TR-25-1975) Avail: NTIS CSCL 11/4

A three phase program to improve the impact resistance of composite materials was undertaken. In the first phase, the Charpy impact test is investigated as a method for characterizing dynamic behavior. The importance of differentiating between the energies of crack initiation and crack propagation is discussed,

and a parameter called the Ductility Index is proposed, together with maximum stress and work of fracture for comparing the dynamic fracture behavior of fiber composites. Slow three point bending and instrumented impact tests were carried out to investigate the quasi-static and dynamic fracture behavior of (1) unidirectional fiber composites consisting of carbon and glass fibers embedded in an epoxy resin matrix; (2) cross-ply carbon fiber-reinforced epoxy resin composites, and (3) a carbon fiber/glass fiber/epoxy resin hybrid composite. It was found that fiber hybridization could raise both the fracture stress and toughness, and ductility index of carbon fiber composite materials. GRA

N76-20427 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Abteilung R01,
ABLATION CHARACTERISTICS OF CFC MATERIALS
H. Grallert *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 51-65 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-20235 Illinois Univ., Urbana.
AN INVESTIGATION OF THE DYNAMICS AND CONTROL OF A WELL-STIRRED COMBUSTOR Ph.D. Thesis
Daniel Adams Crowl 1976 278 p
Avail: Univ. Microfilms Order No. 76-6738

Mathematical models, simulations, and experimental studies were used to investigate the dynamic behavior of an open, well-stirred combustor. An overall kinetic scheme was used to predict both transient and steady state behavior of the combustor. Subsequent stability and control analysis suggested that stabilization of the intermediate unstable states could be achieved by manipulating the inert flow with the combustor temperature being the measured variable. An experimental jet-stirred combustor of small volume was constructed. Adiabatic and nonadiabatic data were taken for the carbon monoxide system. The apparatus demonstrated that stabilization of the unstable combustion states could be achieved. The shape of the theoretically derived multiple steady state curve was verified. Overall rate data derived from the unstable region was found to be at least as good as rate data obtained from the stable regions. Dissert. Abstr.

N76-20236 Illinois Univ., Urbana.
DEVELOPMENT AND EVALUATION OF AN AUTOMATED SAMPLE AND REAGENT HANDLING SYSTEM FOR ANALYTICAL AND CLINICAL APPLICATIONS Ph.D. Thesis
Brian William Renoe 1975 267 p
Avail: Univ. Microfilms Order No. 76-6921

To implement the concept of sample handling using weights of solution two versatile instruments were developed. These instruments are capable of stand alone operation for use with manual analytical instrumentation. When the instruments are interfaced to automated analytical instrumentation, they perform as a buffer for changing samples into a form compatible with the measurement instrument. The sample handling instruments developed are called the AUTOPREP. The AUTOPREP instruments are evaluated with respect to their accuracy and precision for solution handling. The instrumentation is also tested within several operating modes to assess its utility with both manual and automated analytical procedures. The flexibility of the AUTOPREP hardware and the weight information concept are demonstrated with several examples including an automated investigation of the Jaffe reaction for creatinine. The implication of using the instruments in routine analytical procedures, including addition methods is explored. Dissert. Abstr.

N76-20237 Illinois Univ., Urbana.
AN AUTOMATED SPECTROMETER FOR THE INVESTIGATION OF CHEMICAL REACTIONS AND APPLICATION TO THE STUDY OF THE JAFFE REACTION Ph.D. Thesis
Kelly Ray OKeefe 1975 198 p
Avail: Univ. Microfilms Order No. 76-6895

An automated, computer-controlled instrumental system that incorporates a novel, versatile solution-handling module and a highly precise and accurate stopped-flow spectrophotometer was developed. With this instrumental system solutions are prepared from several stock solutions and the resulting solutions are sampled by the stopped-flow spectrophotometer. The sampled solution is mixed with a second (reagent) solution and resulting reactions are monitored by high-precision UV-visible absorption measurements. Both the solution-handling module and the stopped-flow spectrophotometer are controlled by a digital computer. This instrumentation was applied to the investigation of the Jaffe reaction and a method developed for the determination of creatinine in biological samples by a reaction rate spectrophotometric method. Dissert. Abstr.

N76-20238 Bryn Mawr Coll., Pa.
A STUDY OF PRESSURE BROADENING OF THE MICROWAVE SPECTRUM OF HYDROXYL RADICAL Ph.D. Thesis
Barry Neal Lurie 1975 90 p
Avail: Univ. Microfilms Order No. 76-6016

An investigation of the influence of intermolecular collisions on pressure broadening of lines in microwave spectra is undertaken. Collision cross sections and the associated Fourier transforms of the correlation functions are calculated for a variety of potentials, including the Lennard-Jones potential and the Krieger potential. Tangents of loss and absorption line shapes at peak height are calculated for the specific case of the delta-doubling transitions of hydroxyl radical, and the results using the Krieger and Lennard-Jones potentials are discussed. Dissert. Abstr.

N76-20239*# Wayne State Univ., Detroit, Mich. Dept. of Biochemistry.
ELECTROPHORETIC SEPARATION OF PROTEINS IN SPACE Final Report
Ray K. Brown 1976 59 p refs
(Contract NAS8-29823)
(NASA-CR-144225) Avail: NTIS HC $4.50 CSCL 06A

Commercially available and synthetic wide range and short range ampholytes used in the isoelectric focusing of proteins was analyzed by ion exchange chromatography. A pH gradient over the pH range 3.8 to 11.0 was used to elute the ampholytes from a column of a sulfonated polystyrene resin. The wide range ampholytes were resolved into some 60 to 70 ninhydrin positive components. The recovery obtained with the method was quantitative. Acid short range ampholytes have approximately 35 components which elute readily from the ion exchange resin. Basic short range ampholytes gave about 50 components, most of which eluted at alkaline pH. Author

N76-20240*# Kanner (Leo) Associates, Redwood City, Calif.
MECHANISM OF THE OXIDATION AND COMBUSTION OF HYDROGEN
A. B. Nalbandyan, V. V. Voyevodskiy, and V. N. Kondratyev, ed. Washington NASA Mar. 1976 191 p refs Transl. into ENGLISH of the book "Mekhanizm Okisleniya i Goreniya Vodoroda" Moscow-Leningrad, USSR Acad. of Sci. Press, 1949 p 1-180
(Contract NASw-2790)
(NASA-TT-F-16909) Avail: NTIS HC $7.50 CSCL 21B

Oxidation and combustion of hydrogen occurring at temperatures not above 500-600 C and pressure to 1-1.5 atm is treated. The complex kinetics law of this process is interpreted and a specific reaction scheme is derived from it. Calculations and experiments by various authors are mutually compared and common results are set forth. Studying the oxidation of hydrogen is viewed as the first step preceding the analysis of the oxidation of more complex hydrogen-containing compounds. Author

N76-20241*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
STUDY OF EFFECTS OF INJECTOR GEOMETRY ON

FUEL-AIR MIXING AND COMBUSTION Progress Report, Aug. 1975 - Mar. 1976
Louis H. Bangert Mar. 1976 51 p refs
(Grant NGR-11-002-177)
(NASA-CR-146774) Avail: NTIS HC $4.50 CSCL 21B

A series of experiments and the supporting analysis relating the characteristics of fuel injector geometry to the fuel-air mixing and combustion were pursued. The following activities were reported: (1) a calculation for mean flow properties in turbulent diffusion flames, using modeling that explicitly neglects density fluctuations, and in which the reaction rate is a function of turbulence time scale (macroscale) and time-average mass fractions of fuel and air. An estimate of reaction rate is made, based on dimensional analysis, (2) the development of a finite-difference solution for the near field of a fuel injector in supersonic, turbulent flow. Details of the numerical method are given, including the formulation of boundary conditions. The status of the program verification is described, and (3) progress in analysis of experimental data obtained in this program. Author

N76-20242# Naval Weapons Support Center, Crane, Ind.
A SURVEY OF FLASH PHOTOLYSIS, ENERGY DISTRIBUTIONS AND NITROUS OXIDE PHOTOCHEMISTRY Final Report, 1 Mar. - 30 Jun. 1975
Henry A. Webster, III 1 Oct. 1975 18 p refs
(AD-A017479; NWSC/CR/RDTR-15) Avail: NTIS CSCL 07/4

This report describes work in the areas of flash photolysis and kinetic spectroscopy as it relates to a measurement and description of the distribution of reaction energies in the molecular products of exothermic chemical reactions. A brief review of experimental and theoretical methods of describing product energy distributions is given. This review includes a somewhat detailed discussion of the technique of flash photolysis. The photochemistry of nitrous oxide and nitrous oxide reactions with O(singlet D state) are discussed. GRA

N76-20243# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
TURBULENCE IN FREE DIFFUSION FLAMES OF HYDROGEN-NITROGEN MIXTURES BURNING IN STILL AIR Final Report, Aug. 1971 - Dec. 1972
Roger R. Craig Jun. 1975 159 p refs
(AF Proj. 3012)
(AD-A016454; AFAPL-TR-74-68) Avail: NTIS CSCL 21/2

The research undertaken in this report deals with the measurement of time averaged flow variables and turbulence intensities in turbulent diffusion flames. The difficulties encountered in separating the effects of temperature, velocity and species concentration on a hot-film anemometer signal required the use of special techniques for measuring the turbulence in the diffusion flames. Results obtained in an axisymmetric air jet are compared with data obtained from a crossed hot-film anemometer. The axial turbulence equations are then derived. Large increases in the axial turbulence intensity, as well as in the jet core length, are found in the diffusion flame, along with reductions in the radial turbulence intensity. Results are examined in light of the general momentum and turbulence intensity equations for flows with density fluctuations and are seen to be consistent with effects deducible for a density-velocity fluctuation correlation. GRA

N76-20244# Atlantic Research Corp., Alexandria, Va.
EVALUATION OF THE RING OVEN TECHNIQUE FOR WATER MONITORING Final Report, 1 May 1973 - 30 Sep. 1975
R. E. Snyder, M. E. Tonkin, and A. M. McKissick 30 Sep. 1975 211 p
(Contract DADA17-73-C-3112)
(AD-A017062) Avail: NTIS CSCL 07/2

The feasibility of using spot tests coupled with ring oven separation for the monitoring of selected species in natural water sources was demonstrated. The species investigated and their concentration ranges were iron (0.1-10 ppm); lead (0.0 5-1.0 ppm); magnesium (10-5000 ppm); zinc (1-20 ppm); chlorides (10-20,000 ppm); fluorides (0.1-10.0 ppm); nitrates (1.0-20 ppm); sulfates (10-3000 ppm); copper (0.1-5 ppm); calcium (20-10,000 ppm); cadmium (0.01-0.1 ppm); chromium (0.0-1-1 ppm) cyanide (0.1-5 ppm); manganese (0.02-2 ppm); and phosphate (0.02-2 ppm). GRA

N76-20245# Atlantic Research Corp., Alexandria, Va.
EVALUATION OF THE RING OVEN TECHNIQUE FOR WATER MONITORING, APPENDICES
Roger E. Snyder, Martha E. Tonkin, and Alton M. McKissick 30 Sep. 1975 108 p refs
(Contract DADA17-73-C-3112)
(AD-A017063) Avail: NTIS CSCL 07/2

In this document is the appendix that contains the results of the trial detection reagent evaluations for the 15 ions examined during this program. Reaction mechanisms and product structures are included if known. GRA

N76-20246# General Electric Co., Lynn, Mass. Direct Energy Conversion Programs.
RECLAMATION OF ACID RINSE WATER Final Technical Report
R. M. Dempsey and A. B. LaConti Mar. 1975 47 p refs
(Contract DAAK02-73-C-0407)
(AD-A009167) Avail: NTIS CSCL 07/1

Manufacturing techniques were modified and optimized for preparing composite films of sulfonated P30 (a polyphenylene oxide). Polymer ion exchange capacity (IEC) was coated onto promising porous substrate materials using a meniscus coating technique. Composite films of the 1.5 IEC polymer on Celgard KKX-2 porous polypropylene appeared to offer the most promise for meeting the requirements of 10 GSFD flux and 90% acid rejection of a feed containing 0.2% H_2SO_4 and 0.1% HNO_3. Manufacturing procedures were developed and optimized to prepare tighter composite films of S-P30 on Celgard KKX-2 porous polypropylene. Production-type spiral modules were life tested with a feed containing 2000 ppm $NaNO_3$. It is suggested that the meniscus coating technique be extended to development of composite films of S-P30 on laminated porous polysulfone. GRA

N76-20247# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Sanitary Sciences Div.
THE FEASIBILITY OF CONCENTRATING/SEPARATING DILUTE NITROCELLULOSE ACID WASTE WATERS BY REVERSE OSMOSIS Interim Report, Aug. 1972 - Jun. 1974
Vincent J. Ciccone Nov. 1974 49 p
(AD-A008962; USAMERDC-2119) Avail: NTIS CSCL 07/1

This feasibility study focused on the application of membrane technology for the concentration and/or separation of dilute acid wastewaters. Preliminary laboratory investigations using commercially available cellulose-acetate reverse osmosis RO membranes were conducted. The objective of this study was to concentrate the dilute acids as a unit process toward abating the nitrate pollution problem or as an intermediate step in the recovery of the nitric and sulphuric acids. Results of these preliminary investigations indicated that RO was a potential candidate for larger scale application and, therefore, more detailed work was warranted. Of special interest was the development of an acid-resistant membrane to counter the susceptibility of cellulose-acetate to hydrolysis when continuously exposed in an acid environment. The application of cellulose-acetate and modified sulfonated polyphenylene oxide RO membranes as a unit process in the treatment of dilute acid wastewaters generated at the nitrocellulose manufacturing plant is technically feasible. Acidic corrosion of the metallic components of the RO system can introduce operational problems that will significantly interfere with the rejection and flux rates of the RO membranes. Author (GRA)

N76-20248# National Bureau of Standards, Washington, D.C. Center for Fire Research.
FIRE INCIDENTS INVOLVING FLAMMABLE LIQUIDS, GAS, AND DRY EXPLOSIVES Final Report
Elaine A. Tyrrell Oct. 1975 59 p refs
(PB-246862/7; NBSIR-75-784) Avail: NTIS HC $4.50 CSCL 13L

From the NBS Flammable Fabrics Accident Case and Testing System as of December 1973, flammable liquids, gas, and dry explosives were found to be involved in 832 incidents, injuring 863 victims. Volatile flammable liquids represented 77 percent

of the incidents; 72 percent of these liquids were gasoline. Male victims out-numbered females more than 3 to 1. Young adults, ages 21 to 45, and youth, ages 13 to 20, were injured most frequently. Children and youth were injured primarily through what was considered as play activities. Adults generally were injured while engaged in activities traditionally considered as being oriented to the particular sex involved. Streetwear, particularly shirts/blouses, was reported most frequently as igniting first. GRA

N76-20249# Ultrasystems, Inc., Phoenix, Ariz. Dynamic Science Div.
SPILLED FUEL IGNITION SOURCES AND COUNTERMEASURES Final Summary Report, Mar. 1974 - Aug. 1975
Nov. 1975 28 p refs
(Contract DOT-HS-4-00872)
(PB-246281/0; Dyn-Sci-2310-75-119; DOT-HS-801-744)
Avail: NTIS HC $4.00 CSCL 13L

The conditions under which motor vehicle crash fires are ignited are defined and practicle countermeasures are proposed to reduce the incidence t pf t of these fires. Ignition sources, such as electric sparks and headlight filaments, and fuel spillage were investigated. Inertial switches to shut off electrical system in a crash and plastic shields for the positive battery terminal were developed along with fuel system countermeasures to prevent spillage. A cost-benefit analysis found that the developed countermeasures eliminated 100% of crash fires when used together, but they were not cost effective. Author

N76-20250# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
SUPPORTED MOLTEN ELECTROLYTE CATALYSTS Progress Report, Jun. - Dec. 1973
Peter R. Rony Jan. 1974 36 p refs
(Grant NSF GI-37991)
(PB-245970/9; NSF/RA/T-74-052) Avail: NTIS HC $4.00 CSCL 07D

Construction and debugging of a vapor-phase screening catalytic reactor that permits experimental studies at temperatures to 650 C, pressures to 500 psig, and space velocities ranging between 75 and 6,000 GHSV at STP was completed. In preliminary studies, sulfur-tolerant methanation of a feed stream of nominal composition CO:H2:COS = 1:1:0.04 was observed at temperatures exceedings 250 C and pressures ranging between 100 and 400 psig. The water-gas shift reaction was observed to proceed at rapid rates at temperatures of 175 C and a pressure of 100 psig; the shift catalyst is also quite active at one atmosphere pressure. GRA

N76-20251# California Univ., Berkeley. Dept. of Mechanical Engineering.
AN INTRODUCTORY SUMMARY OF HEAT TRANSFER FUNDAMENTALS RELATED TO FIRE
P. J. Pagni Jul. 1975 32 p refs Sponsored by NSF
(PB-246959/1; UCB-FRG-75-19; NSF/RA/T-75-033) Avail: NTIS HC $4.00 CSCL 13L

These notes are from a one day short-course given at the University of California in 1973 entitled 'Understanding Fire Safety' and intended for fire professionals. No background in heat transfer is assumed. The purpose is to provide useful expressions for very approximate heat tranfer calculations while conveying the physics of heat transfer phenomena with a minimum of mathematics. Simple examples are drawn from fire related problems. It is hoped that once this background information is available, similar courses can be directed to practical applications pertinent to this group. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-20252 Wisconsin Univ., Madison.
CRACK INITIATION AND PROPAGATION IN DUCTILE IRONS Ph.D. Thesis
Joseph Olaitan Titilayo Adewara 1975 254 p
Avail: Univ. Microfilms Order No. 75-28780

Initiation and propagation of cracks in ductile irons in annealed, as-cast, and normalized conditions were studied. Specimens with flat polished faces were used, and were strained to different levels. At each strain level, plastic deformation patterns formed on the polished surfaces were examined using light and scanning electron microscopes. Also the modes of crack formation and sites of cracks were studied. Micrographs of the interior of the specimens were also prepared to relate crack initiation and propagation as observed on the surface with those in the interior of the materials. The results showed that crack initiation in ferritic ductile irons involved an extremely high plastic deformation in the vicinity of the graphite nodules relieving the stress concentration effects of the nodules, caused voids to be formed at the poles of the nodules, resulted in the necking and fracturing of the matrix bridges between close nodules. Propagation of cracks in annealed ductile irons was from one nodule to another and particularly along paths that connected maximum number of nodules. Dissert. Abstr.

N76-20253 Cornell Univ., Ithaca, N.Y.
DETERMINATION OF THE BINDING ENERGY OF SMALL ION PARTICLES AS A FUNCTION OF PARTICLE SIZE Ph.D. Thesis
Howard J. Freund 1975 94 p
Avail: Univ. Microfilms Order No. 76-5938

By shock heating moderately volatile metal bearing compounds (for example Fe(CO)5 highly diluted in argon) supersaturated metal vapors were generated at controlled densities and temperatures. The subsequent homogeneous condensation was studied by measuring the turbidity of the gas as a function of distance behind the shock front. Determinations of density gradients behind the shock front, using the laser schlieren technique, give data on the rates and enthalpies of the exothermic reactions (in this case; condensation of metal droplets) which occur. A model was developed to account for these observations and permitted an evaluation of parameters which specify the particle size distribution as a function of time, and the average size to which the particles grow for any set of experimental conditions. Dissert. Abstr.

N76-20254 Pittsburgh Univ., Pa.
CHEMICAL VAPOR DEPOSITION, ITS APPLICATION TO ALLOY FORMATION AND ITS REACTION KINETICS Ph.D. Thesis
William Arthur Bryant 1975 169 p
Avail: Univ. Microfilms Order No. 76-5418

The fundamental features of chemical vapor deposition are discussed and then utilized in a preliminary selection of deposition parameters for preparing the tantalum base alloys T-111 and Ta-10W. A unique process of deposition, wherein the reactant gases and product gases are respectively injected into and evacuated from a reaction chamber at short, repeated intervals, is described. An apparatus for instituting this process was designed and built. The results of preliminary analyses suggested that the respective chloride of each element in the T-111 (tantalum, tungsten and hafnium) be hydrogen reduced at about 1300 C. It was further concluded that the preferred deposition sequence for T-111 consists of alternate micro-layers of tungsten and an alloy of tantalum and hafnium while the sequence for Ta-10W consists of alternate micro-layers of tantalum and tungsten. A method for developing chemical vapor deposition rate equation is demonstrated. Dissert. Abstr.

N76-20255+ Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.
IMPROVEMENT OF PROTECTIVE COATINGS FOR TURBOMACHINE SUPERALLOYS. CORROSION PROTECTION AT HIGH TEMPERATURES Final Report [ESSAIS D'AMELIORATION DES REVETEMENTS PROTECTEURS CONTRE LA CORROSION A HAUTE TEMPERATURE DES SUPERALLIAGES UTILISES DANS LES TURBOMACHINES]
Robert Pichoir Mar. 1975 64 p refs In FRENCH
(Contract DGRST-73-7-1815)
Avail: NTIS HC $4.50

Various alloys obtained by cementation were studied with

regard to formation and oxidation degradation. The direct aluminizing method was compared with that of pretreatment followed by aluminizing. New coatings were prepared by electrode position of either metal or simple alloy, with thicknesses around 20 to 30 microns, transformed by aluminization or of alloys with thicknesses 100 to 150 microns and well suited to resist oxidation and corrosion. In neither case does the superalloy participate directly in the coating formation. This finding is of importance for oriented eutectics with carbon fibers or cobalt based alloys. Substrates used are mainly IN 100; COTAC 3; MAR.M.509. ESA

N76-20256+ Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.

CHLORIDE INDUCED THERMAL STRESS CORROSION OF TITANIUM ALLOYS Final Report [ETUDE DE LA CORROSION SOUS TENSION A CHAUD DES ALLIAGES DE TITANE PAR LES CHLORURES]

Henry Martinod Mar. 1975 21 p ref In FRENCH
(Contract DGRST-73-7-1814)
Avail: NTIS HC $3.50

When samples of TA6V covered with a coating of NaCl are maintained in elongation at 400 to 500 C, cracks are initiated by electrochemical attack. The cracks were found to be due to cleavings in phase alpha connected by sinuous elements crossing or bypassing the data phase. Cleavages occur along a well determined crystallographic plane at about 15 deg to the base plane alpha. Hence a significant anisotropy occurs in the crack resistance in strongly structured products. The influence of the crystalline structure is shown to be almost negligible in respect to the environmental parameters and the characteristics of sodium chloride coating. ESA

N76-20257+ Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ELECTRONIC MICROPROBE APPLICATION TO ORIENTED ALLOY SOLIDIFICATION Final Report [APPLICATION DE LA MICROSONDE ELECTRONIQUE A L'ETUDE DIRECTE DE LA SOLIDIFICATION ORIENTEE DES ALLIAGES]

J. P. Trottier, Y. Bienvenu, B. Daigne, and F. Girard Aug. 1974 55 p refs In FRENCH
(Contract DGRST-72-7-0063)
Avail: NTIS HC $4.50

The electronic microprobe was used in the experimental study of Pb-Sn and Al-Cu alloy solidification. The problems relating to liquid-solid interface observation were considered. A sample holder heatable to 1,000 C allowing for unidirectional solidification under a temperature gradient of 200 C/cm over 2 cm length is described. Formation and growth defects were observed in Pb-Sn and Al-Al2 Cu eutectics. An experimental confirmation of theoretical results of the Cu distribution in Al rich Al-Cu alloys during solidification was obtained together with the proportion of Cu in the liquidus and solidus and the diffusion coefficient for Cu in the liquid. ESA

N76-20258*# Alabama Univ., Huntsville. School of Graduate Studies and Research.

STUDIES ON IMMISCIBLE ALLOYS Final Report, 1 Jun. 1973 - 31 Oct. 1975

Guenther Otto Jan. 1976 106 p refs
(Contract NAS8-27809)
(NASA-CR-144226; UAH-RR-181) Avail: NTIS HC $5.50 CSCL 11F

To illustrate the behavior of immiscible liquids of different densities in zero-gravity and to determine the rate of coalescence like droplets, a demonstration experiment was performed on the Skylab 4 mission. Dispersions of oil-in-water and of water-in-oil were prepared by the astronauts and their appearance photographed over a time span of 10 hours. The experiment indicated that all emulsions were stable over this period and that the coalescent rate was at least 3 times 10 to the 5th power times smaller on Skylab than on earth. The recorded melting of a cylindrical piece of ice on Skylab 3 is used to study the mode of heat transfer for the latent heat of melting in low-gravity. Author

N76-20259# California Univ., Berkeley.

LATTICE IMAGE STUDIES OF ORDERED ALLOYS

R. Sinclair and J. Dutkiewicz Apr. 1975 6 p refs Presented at the 33d Annual Meeting of the Electron Microscopy Soc. of Am., Las Vegas, 11 Aug. 1975
(Contract W-7405-eng-48)
(LBL-3781; Conf-750825-4) Avail: NTIS HC $4.00

Lattice imaging in electron microscopy was successfully applied to the study of ordering in alloys. The approach included computer simulation (Mg3Cd), study of atomic arrangements near ordered lattice defects (Ni4Mo), fringe changes during phase transformation, and identification of fringe periodicities in alloys quenched from above the critical ordering temperature. NSA

N76-20260# Atomic Weapons Research Establishment, Aldermaston (England).

POLAROGRAPHIC METHODS FOR THE ANALYSIS OF BERYLLIUM METAL AND ITS ALLOYS

J. M. Wells Oct. 1975 50 p
(AWRE-O-34/75) ERDA Depository Libraries; HC $5.50

Polarographic methods for the analysis of beryllium metal and its alloys are described. The elements covered by these methods are aluminum, bismuth, cadmium, cobalt, copper, iron, lead, molybdenum, nickel, thallium, tungsten, uranium, vanadium and zinc. Author (NSA)

N76-20261# Oak Ridge National Lab., Tenn.

DEPTH DISTRIBUTION OF DAMAGE IN COPPER IRRADIATED WITH MeV, Ni AND He IONS

J. Narayan, T. S. Noggle, and O. S. Oen 1975 10 p refs Presented at Intern. Conf. on Radiation Damage in Metals, Gatlinburg, Tenn., 5 Oct. 1975 Sponsored by ERDA
(CONF-751006-4) Avail: NTIS HC $4.00

Transmission electron microscopy was used to study radiation damage as a function of depth caused by 58 and 4-MeV Ni(-58) and 1-MeV He ions in copper single crystals at ambient temperature. The experimental damage density vs penetration depth distributions was compared with calculations based on the atomic collision theory (LSS). For 58-MeV Ni ions, the calculated damage profile using the theoretical LSS value of the electronic stopping parameter (k equals 0.167) agrees well with experiment. However, for 4-MeV Ni ions it is necessary to use k equals 0.12 to get agreement with the experimental data. In the case of 1-MeV He, the depth location of the calculated damage peak is in good agreement with experiment when the electronic stopping determined by Chu and Powers is used whereas it is about 15 percent too close to the surface using the tables of Northcliffe and Schilling. Author (NSA)

N76-20262# Ames Lab., Iowa.

HYDROGEN EMBRITTLEMENT AND OTHER EFFECTS IN THERMONUCLEAR REACTOR MATERIALS

T. E. Scott Jun. 1975 73 p refs Presented at 4th Annual Spring Meeting of the Metallurgical Society of AIME, Boston, 8 May 1972
(Contract W-7405-eng-82)
(IS-3634; Conf-720515-5) Avail: NTIS HC $6.75

Current fusion reactor design concepts are based on deuterium-tritium plasma fuel. The fuel and possible internal proton creation by (n,p) reactions provide sources of hydrogen isotopes which may have serious deleterious effects on the integrity of containment materials in a thermonuclear reactor. The potential deleterious effects of hydrogen isotopes on the mechanical behavior of candidate containment materials, such as vanadium, niobium, molybdenum and others are considered. Current knowledge of hydrogen-induced embrittlement in these metals is reviewed in relation to CTR application and other potential material problems caused by hydrogen isotopes under fusion reactor operating conditions are indicated. Related information such as hydrogen solubility, hydrogen-metal phase diagrams, and hydrogen diffusivity are included. Author (NSA)

N76-20263# Battelle Pacific Northwest Labs., Richland, Wash.

FUNDAMENTALS OF CORROSION CONTROL DESIGN

L. D. Perrigo 5 Feb. 1975 44 p refs Presented at 9th Western States Corrosion Seminar, Pomona, Calif., 6 May 1975; Sponsored by Natl. Assoc. of Corrosion Engr.
(Contract AT(45-1)-1830)

(BNWL-SA-5289; Conf-750410-1) Avail: NTIS HC $5.25

Simple and straightforward principles are applied to the design of systems, buildings and equipment in order to reduce, operational corrosion problems. These corrosion control design principles are concerned with promoting the use of orientation, layout, and configurations to avoid the holdup of solutions, abrupt flow changes, impingement, and stagnant areas. Climatic conditions and terrain are important siting considerations in reducing atmospheric corrosion of buildings and facilities. A determined effort is needed to broaden the understanding of anti-corrosion design measures and principles because these are not widely known and recognized by designers and architects.Author (NSA)

N76-20264# European Space Research and Technology Center, Noordwijk (Netherlands).

THE PROPERTIES OF NEAR-EUTECTIC TIN/LEAD SOLDER ALLOYS TESTED BETWEEN PLUS 70 AND MINUS 60 C AND THE USE OF SUCH ALLOYS IN SPACECRAFT ELECTRONICS

B. D. Dunn Paris ESA Sep. 1975 23 p refs

(ESA-TM-162-ESTEC) Avail: NTIS HC $3.50

Metallurgical and tensile properties of commercially available tin/lead solder alloys have been compared. The addition of certain trace elements to the alloys is discussed. The pure eutectic solder specified as ESRO 63 is recommended for the assembly of components to printed circuit board; this alloy has the lowest viscosity, thus facilitating flow in plated-through holes.

Author (ESA)

N76-20265# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF SELECTED REFRACTORIES AS HIGH TEMPERATURE THERMOPHYSICAL PROPERTY CALIBRATION MATERIALS Final Report, 1 Jun. 1972 - 1 Dec. 1973

Merrill L. Minges Aug. 1975 76 p refs

(AF Proj. 7340; AF Proj. 7381)

(AD-A016472; AFML-TR-74-96) Avail: NTIS CSCL 14/2

Two materials, tungsten and an isotropic graphite, were selected out of a list of twenty-two materials for more detailed evaluation on their reliability for being a high temperature thermophysical property reference standard. High temperature thermal property and electrical resistivity measurement results from an expanded international measurement program are presented and compared which involved 18 laboratories, nine in Europe and nine in the U.S. It was concluded, that the thermal conductivity and thermal diffusivity of the graphite were known within + or - 10% and + or - 6% respectively while for the tungsten the corresponding inaccuracy bounds for both properties were + or - 5%. Specific recommendations are given for further experimental and analytical studies with these two calibration materials. GRA

N76-20266# Naval Intelligence Support Center, Washington, D.C.

THE EFFECT OF PRESSURE OF THE CORRODING LIQUID ON THE STRENGTH OF METALS DURING LOW CYCLE FATIGUE TESTING

V. S. Utkin and L. S. Moroz 30 Sep. 1975 10 p refs Transl. into ENGLISH from Tr. Sev.-Zapadnyi Zaochnyi Politekh. Inst. (Leningrad), no. 16, 1971 p 9-15

(AD-A016386; NISC-Trans-3690) Avail: NTIS CSCL 11/6

A negative effect of different corroding media, including water, on the strength of materials subjected to variable stresses has been known for some time. A large number of industrial equipment (pipes, reservoirs, tanks, etc.) are subjected simultaneously to variable stresses and high pressures produced by corroding liquid media. The performance of structural elements under these conditions is lowered, as well as their useful service life. This work was undertaken to study the effect of the water pressure (0-200 atm) on low cycle fatigue of cylindrical specimens (with a circular cut) made of different alloys. GRA

N76-20267# California Univ., Berkeley. Dept. of Mechanical Engineering.

DEFORMATION MODE OF VOID-GROWTH AND COALESCENCE IN THE PROCESS OF DUCTILE FRACTURE Final Report, May 1974 - Mar. 1975

S. I. Oh and Shiro Kobayashi Jul. 1975 84 p refs

(Contract F33615-72-C-1645; AF Proj. 7351)

(AD-A016473; AFML-TR-75-95) Avail: NTIS CSCL 11/6

The objective of this investigation was to develop a fracture criterion applicable to the prediction of the occurrence of cracks in metal-working processes. A model for large void growth was proposed, and the deformation mode was calculated by the elastic-plastic finite-element method. The results of the calculation showed the formation of a shear band between large voids. The proposed fracture criterion is that the growth and coalescence of small voids along this shear band is the final process of fracturing. The fracture strain was estimated for a material by applying the McClintock analysis to small void coalescences. The proposed model offers an explanation for some important aspects of experimental observations of ductile fracture. GRA

N76-20268# Army Materials and Mechanics Research Center, Watertown, Mass.

MONITORING FATIGUE FAILURES OF A HIGH STRENGTH TITANIUM ALLOY BY ACOUSTIC EMISSION TECHNIQUES Final Report

Samuel J. Acquaviva and Richard Chait Jun. 1975 16 p Presented at the 10th NDE Symp., San Antonio, 23-25 Apr. 1975

(AD-A016867; AMMRC-PTR-75-2) Avail: NTIS CSCL 11/6

This effort describes the application of acoustic emission techniques to cyclically loaded specimens in an attempt to detect crack initiation. Both notched and unnotched fatigue specimens were cycled at 30 cps in the low cycle fatigue region, i.e., the stress level in each test was above the endurance limit of the material. Fifteen specimens, both notched (K sub T = 4.0) and unnotched, were tested. Results of the tests on the unnotched specimens indicate acoustic emission signals being recorded 30 to 150 cycles prior to fracture; and the crack initiation and propagation phases appear to be quasi-simultaneous as expected in a high strength material. The tests on the notched specimens indicate acoustic emission signals corresponding to crack initiation being recorded as long as 2500 cycles prior to fracture. As a result of this study, it appears that acoustic emission can be a useful technique for detecting material flaws prior to catastrophic failure. Author (GRA)

N76-20269# Failure Analysis Associates, Palo Alto, Calif.

PROBABILISTIC FRACTURE MECHANICS

P. M. Besuner and A. S. Tetelman Jul. 1975 68 p refs Sponsored by Elec. Power Res. Inst.

(PB-246255/4; FAA-75-4-6; EPRI-217-1-TR-4) Avail: NTIS HC $4.50 CSCL 11F

Methodology is developed for probabilistic fracture mechanics analysis (PFM) of structural components with crack-like imperfections. Details are given for the development and application of both a simple nomographic method and a basic numerical tool for PFM applications. Two illustrative applications based on linear elastic fracture mechanics are included to demonstrate the utility of PFM. The first example selects the mean yield strength of an alloy in order to minimize the probability of failure for a hypothetical component with two failure modes, yielding and brittle fracture. The second example points out the need for and current unavailability of required input data. GRA

N76-20270# Pennsylvania State Univ., University Park. Dept. of Mineral Economics.

AN ECONOMIC ANALYSIS OF THE DETERMINANTS OF METAL RECYCLING IN THE UNITED STATES: A CASE STUDY OF SECONDARY COPPER Final Report

Elizabeth Semon Bonczar May 1975 90 p refs

(Grant G0133114)

(PB-245832/1; BM-OFR-79-75) Avail: NTIS HC $5.00 CSCL 11F

The relative importance of major factors affecting supply and demand of secondary copper, which in turn determine the amount of copper scrap recycled are identified and assessed. The analysis is confined to the American secondary copper industry and to the postwar period. An econometric model is developed to aid in this investigation. The data review several econometric models of relevance to this study, describe the institutional framework of the secondary copper industry in the United States,

examine the nature of costs in this industry, analyze the principal factor affecting the supply and demand of copper recovered from scrap, describe the econometric model and the results it produces, summarize the major findings, consider a few of the implications for public policy, and identify avenues for future research. GRA

N76-20271# Bureau of Mines, Reno, Nev. Metallurgy Research Center.
ELECTROLYTIC PREPARATION OF TITANIUM AND ZIRCONIUM DIBORIDES FROM THEIR OXIDES AND MINERAL CONCENTRATES
J. M. Gomes, K. Uchida, and M. M. Wong Jul. 1975 19 p refs
(PB-245561/6; BM-RI-8053) Avail: NTIS HC $3.50 CSCL 11F

Electrolytic techniques were investigated for preparing diborides of the group 4 B metals. TiB2, ZrB2, and HfB2 were electrodeposited from their respective oxides dissolved in borate-chloride-cryolite electrolyte. Titanium diboride was also electrodeposited from rutile dissolved in a Na2B4O7-Na2CO3-Na3AlF6-NaCl electrolyte at 1,050C 14 kW-hrs were required to produce one pound of TiB2. Major impurities in the TiB2 produced in a 10 deposition cycle experiment, in wt-pct, were: Al, 0.2; Cr, 0.3; Fe, 0.1; V, 0.3; C, 1.4; and O, 1.0. Zirconium diboride was electrodeposited from zircon dissolved in a Na2B4O7-NaOH-Na3AlF6-NaCl-NaF electrolyte at 1,050C. The ZrB2 produced in a 10-deposition cycle experiment contained the following impurities in wt-pct: Fe, 0.1; Si, 0.5; C, 0.3; and O 0.6. Energy required to produce one pound of ZrB was 9.3 kW-hrs. GRA

N76-21132 Institut Franco-Allemand de Recherches, St. Louis (France).
DYNAMIC COMPRESSION TESTS WITH COPPER AND ALUMINUM CYLINDERS
G. Weihrauch *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 43-56 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-20272*# General Electric Co., Schenectady, N.Y.
IMPROVED TOUGHNESS OF SILICON CARBIDE Final Report
John A. Palm Jan. 1976 63 p refs
(Contract NAS3-17832)
(NASA-CR-134990; SRD-76-021) Avail: NTIS HC $4.50 CSCL 11B

Impact energy absorbing layers (EALs) comprised of partially densified silicon carbide were formed in situ on fully sinterable silicon carbide substrates. After final sintering, duplex silicon carbide structures resulted which were comprised of a fully sintered, high density silicon carbide substrate or core, overlayed with an EAL of partially sintered silicon carbide integrally bonded to its core member. Thermal cycling tests proved such structures to be moderately resistant to oxidation and highly resistant to thermal shock stresses. The strength of the developed structures in some cases exceeded but essentially it remained the same as the fully sintered silicon carbide without the EAL. Ballistic impact tests indicated that substantial improvements in the toughness of sintered silicon carbide were achieved by the use of the partially densified silicon carbide EALs. Author

N76-20273*# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT OF PROCEDURES FOR CALCULATING STIFFNESS AND DAMPING PROPERTIES OF ELASTOMERS. PART 3: THE EFFECTS OF TEMPERATURE, DISSIPATION LEVEL AND GEOMETRY Final Report
Anthony J. Smalley and J. M. Tessarzik Nov. 1975 218 p refs
(Contracts NAS3-15334; NAS3-18546)
(NASA-CR-134939; MTI-76TR5-Pt-3) Avail: NTIS HC $7.75 CSCL 11D

Effects of temperature, dissipation level and geometry on the dynamic behavior of elastomer elements were investigated. Force displacement relationships in elastomer elements and the effects of frequency, geometry and temperature upon these relationships are reviewed. Based on this review, methods of reducing stiffness and damping data for shear and compression test elements to material properties (storage and loss moduli) and empirical geometric factors are developed and tested using previously generated experimental data. A prediction method which accounts for large amplitudes of deformation is developed on the assumption that their effect is to increase temperature through the elastomers, thereby modifying the local material properties. Various simple methods of predicting the radial stiffness of ring cartridge elements are developed and compared. Material properties were determined from the shear specimen tests as a function of frequency and temperature. Using these material properties, numerical predictions of stiffness and damping for cartridge and compression specimens were made and compared with corresponding measurements at different temperatures, with encouraging results. Author

N76-20274*# North Carolina Agricultural and Technical State Univ., Greensboro. Dept. of Mechanical Engineering.
CREATION OF A CERAMICS HANDBOOK Final Report
William J. Craft 1 Mar. 1976 290 p refs
(Grant NGR-34-012-013)
(NASA-CR-146575) Avail: NTIS HC $9.25 CSCL 11B

A group of common ceramic materials (alumina, magnesium oxide, silicon nitride, and silicon carbide) were characterized through literature searches according to their physical properties. The files used were the NASA file, DDC/GRA File, Engineering Index File and standard library searches. The results of these searches are arranged by material properties including mechanical, electrical, electromagnetic, where applicable, and fracture; and the entries are arranged in chronological order by candidate. A list, by author, follows where tabular information including charts and figures of results is given along with a brief statement of the results and conclusions. In both cases, information on the independent variables along with their range is given. The results of an extensive industry survey asking for names of other candidates on which information is lacking and also what type of service, if any, is desired in keeping a current information file on general ceramic materials. Author

N76-20275*# Washington Univ., Seattle. College of Engineering.
INTERDISCIPLINARY RESEARCH CONCERNING THE NATURE AND PROPERTIES OF CERAMIC MATERIALS Semiannual Status Report
30 Dec. 1975 45 p refs
(Grant NGL-48-002-004)
(NASA-CR-146551; SASR-25) Avail: NTIS HC $4.00 CSCL 11B

The nature and properties of ceramic materials as they relate to solid state physics and metallurgy are studied. Special attention was given to the applications of ceramics to NASA programs and national needs. Author

N76-20276# Technische Hogeschool, Delft (Netherlands).
THE APPLICATION OF FLOW BIREFRINGENCE TO RHEOLOGICAL STUDIES OF POLYMER MELTS Ph.D. Thesis
James Lance Sander Wales 1976 121 p refs
Avail: NTIS HC $5.50

The streaming birefringence of polymer melts was studied with emphasis on their properties in steady shearing flow. The investigation consists of an experimental and a theoretical part. In the experimental part, the construction of new apparatuses for the measurement of streaming double refraction is described: (1) a cone-and-plate apparatus for the measurement as a function of shear rate of the birefringence and the extinction angle in the 1-2 plane, (2) a rectangular slit apparatus for the measurement as a function of shear rate or shear stress of the birefringence in the 1-3 plane, (3) a capillary device with interchangeable dies for the measurement of the birefringence in the 2-3 plane. In the theoretical section, introduction is made to molecular

theories of polymer flow, based on a diffusion equation. A modification is made to the dumbbell, based on the observation that segments of a molecule are rod-like and should have anisotropic diffusion coefficients. The experimental results are shown to be in accordance with the theoretical predictions of the ratio. Author

N76-20277# Westinghouse Electric Corp., Pittsburgh, Pa.
EFFECT OF THE MgO/SiO2 RATIO ON THE STRENGTH OF HOT-PRESSED Si3N4: INTERRELATION BETWEEN CREEP AND SLOW CRACK GROWTH. CRACK EXTENSION AND ARREST: THEORY AND EXPERIMENTS FOR CONTACT STRESS FIELDS Technical Reports for the period ending 15 Oct. 1975
C. A. Anderson, F. F. Lange, and J. L. Iskoe 19 Oct. 1975 55 p refs
(Contract N00014-74-C-0284; ARPA Order 2697)
(AD-A016803; TR-3; TR-4; TR-5) Avail: NTIS CSCL 11/2

The strength of hot-pressed Si3N4 containing different MgO/SiO2 molar ratios was studied. Significant increases in strength at 1400 C were observed as the MgO/SiO2 ratio increased to 3-4. Smaller decreases in strength at both 25 C and 1400 C were observed when MgO/SiO2 = 4. These observations are briefly discussed with regard to possible chemistry changes of the grain boundary phase believed to be present in hot-pressed Si3N4. Phenomenological interrelations between creep strain and slow crack growth are derived based on the fact that the total creep strain at fracture is determined by the growth kinetics of a pre-existing crack. It is shown that measurements of the creep strain in a region remote from the growing crack can be used to predict failure periods for materials that concurrently exhibit creep and slow crack growth. Sudden crack extension and arrest is observed when indenters are pressed into the surface of brittle materials. The energetics of this system is examined to determine the criteria for crack extension and arrest. Experimental observations are presented to confirm the first criterion of crack extension and its relation to material properties. The experiments were performed on hot-pressed Si3N4 and SiC. GRA

N76-20278# General Electric Co., Schenectady, N.Y.
BISPHENOL FLUORENONE CARBONATE-SIMETHYL SILOXANE BLOCK POLYMERS: TRANSPARENT, TOUGH, HEAT AND FLAME RESISTANT THERMOPLASTICS Final Report, 14 Jan. 1974 - 13 Jun. 1975
R. P. Kambour, J. E. Corn, S. Miller, and G. E. Niznik Jul. 1975 101 p refs
(Contract N00019-74-C-0174)
(AD-A017383; SRD-75-093) Avail: NTIS CSCL 07/4

Synthesis on the 100g scale of BPF carbonate-dimethyl siloxane block polymers containing minor amounts of silicone has been improved to the point that resins of the desired silicone content and molecular weight can be closely reproduced. A number of simplifying changes have been made in the synthesis procedure during subsequent scale-up. Extrusion and injection molding of these resins into articles of good clarity and mechanical integrity have been mastered. Color varies from light straw to brownish-yellow currently. The two mechanisms of toughening are observed-stress whitening and shear flow; the former is favored by lower silicone contents and complex stress configurations. Flame resistance is paramount among transparent thermoplastics containing no halogen. Limiting oxygen index is 48-51. Char formation is rapid and extensive. No dripping and little smoke are observed. A synergism between the organic and silicone blocks is suggested to be the cause of the superb flame resistance, which is better than in either corresponding homopolymer. GRA

N76-20279# Stanford Research Inst., Menlo Park, Calif.
DEGRADABLE BINDERS FOR ORDNANCE DISPOSAL Quarterly Progress Report, 26 Jul. - 26 Oct. 1974
Dale G. Hendry, Donald L. Ross, and Gerald E. Manser 8 Nov. 1974 13 p refs
(Contract N00024-75-C-5007; SRI Proj. PYU-3693)
(AD-A009257; QPR-1) Avail: NTIS CSCL 11/9

Diisocyanates available for use in a polyurethane binder were studied. Model polymers were prepared using toluene diisocyanate (TDI), diphenylmethane diisocyanate (MDI), and dimeryl diisocyanate (DDI). Although the properties of the DDI were only adequate, no attempt was made to optimize the curing conditions, which should lead to better properties. GRA

N76-20280# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
INFERRING MECHANICAL RELAXATION SPECTRA, AN ILL-POSED PROBLEM Final Report, May - Oct. 1974
D. R. Wiff and Matatiahu Gehatia May 1975 34 p refs
(AF Proj. 7340)
(AD-A016474; AFML-TR-74-243) Avail: NTIS CSCL 11/9

An effort is made to reduce the number of required mechanical measurements on resin, plastic, and composite specimens. This is achieved by proposing a technique for handling the ill-posed problem of determining a mechanical structural model of a specimen. The results are very encouraging. The report describes in detail the mathematical approach but also presents illustrative graphs comparing assumed mechanical relaxation distributions with those inferred from computer generated experimental data. GRA

N76-20281# Connecticut Univ., Storrs. Inst. of Materials Science.
SYNTHESIS AND TESTING OF POLYMERS SUSCEPTIBLE TO HYDROLYSIS BY PROTEOLYTIC ENZYMES Final Report, 1 Jul. 1973 - 30 Jun. 1974
J. P. Bell, S. J. Huang, and J. R. Knox Aug. 1974 32 p refs
(Contract DAAG17-73-G-0002; DA Proj. 1T0-62105-A-329)
(AD-A009577; USA-NLARS-TR-75-48-CEMEL) Avail: NTIS CSCL 07/3

Certain specific enzymes known to cause hydrolysis of amide and ester bonds in naturally occurring macromolecules are studied. The synthesis, testing, and development of synthetic macromolecules containing biodegradable linkages found in natural polymers are described. The biodegradation of the polymer is measured after exposure to the specific enzymes effective for the type of bond that has been introduced. Emphasis is placed on substituted polyamides and polyesters. Degradation is followed by appearance of the known cleavage product, by molecular weight reduction of the residual solids, and by weight loss. Additional fungal growth studies conducted on polycaprolactone are discussed. Materials under study include: benzylated nylons, amino acid-containing model compounds, polycaprolactone, polymers containing a alpha-hydroxylacids, and modified gelatin. GRA

N76-20282# Purdue Univ., Lafayette, Ind. School of Chemical Engineering.
THE IMMOBILIZATION OF GLUCOSE ISOMERASE IN A GLUTARALDEHYDE CROSSLINKED GELATINE MATRIX M.S. Thesis, Sep. 1973 - Dec. 1974
Johannes Tramper Dec. 1974 88 p refs
(Grant NSF GI-34919)
(PB-246908/8; NSF/RA/T-74-116) Avail: NTIS HC $5.00 CSCL 07D

The immobilization of a partially purified, water-soluble form of glucose isomerase through covalent bonding and/or physical entrapment within a glutaraldehyde gelatine matrix, resulting in an active and stable enzyme preparation, was the objective of this research. Three immobilization techniques were studied: (1) powdered gelatine was added to a cold solution of the enzyme and glutaraldehyde; upon which particles formed immediately; (2) gelatine was first dissolved at 60C, then enzyme solution added and finally sufficient glutaraldehyde to accomplish solidification at 60C; (3) a film was made by pouring a gelatine-enzyme solution onto a polyethylene surface, followed by storage at 4C. Only the last technique gave satisfactory results. GRA

N76-20283# Transportation Research Board, Washington, D.C.
POLYMER CONCRETE
R. Douglas Eash 1975 72 p refs Presented at 54th Ann. Meeting of Transportation Res. Board
(PB-246073/1; TRB/TRR-542; ISBN-0-309-02395-5) Avail: NTIS HC $4.50 CSCL 13C

Contents: Reaction of polymer latexes with Portland cement concrete; Partial polymer impregnation of highway bridge decks; Polymer concrete for repairing deteriorated bridge decks; Innovations in impregnation techniques for highway concrete; Effects of deicer salts and roadway contaminants on polymer

impregnation of bridge deck concrete; Polymer concrete prepared from an MMA-styrene copolymer system; Highway applications of concrete polymer materials. GRA

N76-20423 Stuttgart Univ. (West Germany). Inst. fuer Technische Thermodynamik und Thermische Verfahrenstechnik.
HEAT AND MASS TRANSFER WITHIN TEFLON LAYERS IN ABLATION COOLING
Karl Stephan and Bernhard Holzknecht (Bochum Univ., West Ger.) *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 7-16 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

N76-20428 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.
ABLATION BEHAVIOR OF TEFLON MODELS
K. Kindler *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 67-82 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-20284*# Utah Univ., Salt Lake City. Dept. of Civil Engineering.
MEASURED PROPERTIES OF PROPELLANT FOR SOLID ROCKET BOOSTER OF ONE-EIGHTH SCALE DYNAMIC SHUTTLE MODEL Final Report
William L. Hufferd [1975] 66 p refs
(Grant NsG-1113)
(NASA-CR-144938; UTEC-CE-75-178) Avail: NTIS HC $4.50 CSCL 21I

Static and dynamic material property tests were conducted on inert UTI-610 propellant. Attempts were made to obtain basic mechanical response data for use in the analysis of one-eighth scale models of the space shuttle, SRB. Author

N76-20285# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
DEVELOPMENT OF AN ANALYTICAL MODEL OF HYDRAZINE DECOMPOSITION MOTORS
Jul. 1975 223 p refs
(Contract ESTEC-1121/70-AA)
(ESA-CR(P)-756) Avail: NTIS HC $7.75

Aspects of the development of hydrazine catalytic decomposition thrusters for spacecraft control are dealt with. Processes occurring inside the catalyst particles during the ignition period corresponding to cold starts of the thrusters were studied. A model is presented for the homogeneous gas phase decomposition of highly diluted hydrazine, using singular perturbation methods, that gives the overall reaction rate and stoichiometry for 1000 K initial temperature. An analysis was made of the heat and mass transfer to porous catalyst particles with either endothermic or exothermic reactions under steady state conditions. The steady state behavior of a thruster was studied. Both catalytic and thermal decomposition processes were considered. For individual titles, see N76-20286 through N76-20289.

N76-20286 Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
IGNITION DELAY OF HYDRAZINE MONOPROPELLANT THRUSTERS
J. L. Urrutia, A. Linan, A. Crespo, and E. Fraga *In its* Develop. of an Anal. Model of Hydrazine Decomposition Motors Jul. 1975 51 p refs (For availability see N76-20285 11-28)

The ignition mechanism of hydrazine monopropellant thrusters was studied. It is shown that, due to the large value of the rate constant for the heterogeneous decomposition of hydrazine, this decomposition takes place in a narrow zone adjacent to the gas-liquid interface so that the mass flux of gaseous hydrazine towards the interior of the catalyst particle can be truly ascribed to a diffusion mechanism. Analytical expressions were obtained for the ignition time, i.e., the period between injection of liquid hydrazine and expulsion of gaseous products from the catalyst particles, which correlate well with available experimental results. The ignition time was obtained as a function of the characteristics of the catalyst particle and of the initial conditions of the chamber for the Shell 405 catalyst. ESA

N76-20287 Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
THE HOMOGENEOUS GAS PHASE DECOMPOSITION OF HYDRAZINE BY SINGULAR PERTURBATION METHODS
J. L. Urrutia *In its* Develop. of an Anal. Model of Hydrazine Decomposition Motors Jul. 1975 25 p refs (For availability see N76-20285 11-28)

The conditions under which the decomposition of hydrazine can be described by a single overall reaction with an appropriate reaction rate were investigated. It is shown that the homogeneous gas phase decomposition of hydrazine can be analyzed by using singular perturbation techniques. The reaction can be visualized as composed of four stages with different kinetic mechanisms. However, inspection of the appropriate time scale for each of these steps indicates that the complicated mechanisms of the reaction can be reduced in a first approximation to the overall reaction N_2H_4 yields $2/3\ NH_3 + 2/3\ N_2 + H_2$ for initial high dilution of hydrazine in He and initial temperature of the gas mixture at 1000 K. ESA

N76-20288 Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
STEADY HEAT AND MASS TRANSFER IN POROUS CATALYST PARTICLES
J. L. Urrutia and A. Linan *In its* Develop. of an Anal. Model of Hydrazine Decomposition Motors Jul. 1975 63 p refs (For availability see N76-20285 11-28)

Asymptotic methods were applied to determine the distributions of temperature and concentration within a spherical catalytic particle under steady state conditions. The case in which a chemical decomposition reaction of a species takes place within the particle was analyzed. Temperature and composition of the interstitial fluid surrounding the particle were assumed to be uniform. Closed form expressions were obtained for the effectiveness factor and the apparent particle consumption rate in terms of the overall order of the reaction, the Thiele modulus, the heat release parameter, and the activation energy. ESA

N76-20289 Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
STEADY STATE ANALYSIS OF HYDRAZINE MONOPROPELLANT THRUSTERS
J. L. Urrutia, A. Linan, A. Crespo, and E. Fraga *In its* Develop. of an Anal. Model of Hydrazine Decomposition Motors Jul. 1975 63 p refs (For availability see N76-20285 11-28)

A theoretical analysis of the steady state operation of hydrazine monopropellant thrusters is presented. The length of the chamber is divided into three regions: first, the induction region from the injector to the point where boiling temperature is reached. The hydrazine is in liquid form. Second, the two-phase flow region, the length of which is short compared to the induction length with the temperature remaining constant equal to the boiling temperature. Third, the post-induction region in which the fluid is in gaseous form and both hydrazine and ammonia decompose simultaneously. The temperatures of the interstitial fluid and the surface of the catalyst particle are different. ESA

N76-20290# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
TECHNOLOGY OF COMPOSITE DOUBLE BASE PROPELLANTS PREPARATION [TECHNOLOGIE DER HERSTELLUNG VON COMPOSIT-DOUBLEBASE-TREIBSTOFFEN]
W. Kloehn 30 Oct. 1974 28 p refs In GERMAN
(ICT-2/74) Avail: NTIS HC $4.00

Preparation from nitrocellulose fluid balls, combining properties of both composite and double base propellants, is described. Distinctive features are a high burning rate and good viscoelastic properties. Three procedures for preparation, mixing, casting, and

hardening, are described. Measured propellant properties are given. ESA

N76-20291# Institut fuer Chemie der Treib- und Explosivstoffe, Pfinztal (West Germany).
MECHANICAL TESTING AND SIMULATION OF ENVIRONMENT EFFECTS ON ROCKET PROPELLANTS, GUN POWDER AND CARTRIDGELESS AMMUNITION [VERFAHREN UND METHODEN DER MECHANISCHEN PRUEFUNG ZUR NACHBILDUNG VON MECHANISCHEN UMWELTEINFLUESSEN BEI RAKETENTREIBSTOFFEN, TREIBLADUNGSPULVERN UND HUELSENLOSER MUNITION]
D. Schmitt 31 Dec. 1974 38 p refs In GERMAN
(ICT-7/74) Avail: NTIS HC $4.00

The individual test methods described are suitable for simulation of various environmental conditions. Heat transfer, ignition, and embrittlement problems are considered for solid rocket propellants and gun powder. ESA

N76-20292# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany). Inst. fuer Flugtreib- und Schmierstoffe.
IGNITION BEHAVIOR OF UNIFIED COMPOSITION AVIATION FUELS AND SOME HYDROCARBONS Ph.D. Thesis - Tech. Univ. Munich
Friedrich Koerber 20 Oct. 1975 74 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-67) Avail: NTIS HC $4.50; DFVLR, Cologne DM 26.30

A survey is presented of problems in reignition considering the specific fuel properties. The ignition behavior of aviation fuels and hydrocarbons in a simplified model combustion chamber were investigated. Air inlet conditions were 200 to 800 mbar and 300 to 500 K. The maximum air inlet velocity was introduced as a criterion for fuel ignitability, when ignition by an electric spark behind the flame holder was still occurring. Correlation between physical and chemical porperties and ignitability is discussed. Author (ESA)

N76-20293# Florida Univ., Gainesville. Center for Macromolecular Science.
SOLVOLYTIC DEGRADATION OF POLYMERIC PROPELLANT BINDERS Final Report, 1 Mar. 1974 - 31 May 1975
M. S. Kaufman, R. L. Veazey, R. L. Zampini, S. B. Page, and G. B. Butler Jun. 1975 30 p refs
(Contract N00017-74-C-4335)
(AD-A017235) Avail: NTIS CSCL 07/3

The effect of various catalysts on the rate of solvolysis of the polyester and polyurethane binders in butylamine was studied. Polymer binders in propellants usually constitute from 16 to 20% of the total weight of the propellant. The remaining 84-80% is generally made up of oxidizer, usually (in Polaris motors) ammonium perchlorate (AP) 60-82%, aluminum metal, 2-18%, and stabilizers, 0-1%. The binders of chief concern at present (in Polaris motors) appear to be one of two types: (1) polyurethanes or (2) cured polybutadiene prepolymers. The problem of disposing of obsolete propellants is a formidable one because of the legal limitations on burning and dumping. The product gases from burning would cause serious pollution of the atmosphere and other possible means of disposal also present problems. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-20294*# Scientific Translation Service, Santa Barbara, Calif.
PROBLEMS OF MODERN CRYOGENICS
A. M. Arkhapov, ed., V. I. Belyakov, ed., and M. I. Malkov, ed. Washington NASA Mar. 1976 462 p refs Transl. into ENGLISH of the book "Voprosy Sovremennoy Kriogeniki" Moscow, Natl. Comm. of the Intern. Inst. of Cold, 1975 p 1-400
(Contract NASw-2791)
(NASA-TT-F-16841) Avail: NTIS HC $12.00 CSCL 20L

A collection of articles is presented (in text form) which discusses the achievements and prospects for the development of cryogenics. An analysis is made of electrical machine superconducing (superconducting power transmission) thermal states, hydrodynamics and effectiveness of large air separation plant rectifiers. Other areas investigated were cryopumping, refrigerating equipment, and heat exchangers. Author

N76-20295# Centre National de la Recherche Scientifique, Orleans (France). Centre de Recherches sur la Physique des Hautes Temperatures.
ADAPTATION TO SPACE APPLICATIONS OF A 2000 C FURNACE WITH OXIDIZING ATMOSPHERE [ETUDE DE L'ADAPTATION D'UN FOUR: 2000 C, ATMOSPHERE OXYDANTE A DES APPLICATIONS SPATIALES]
1975 114 p In FRENCH
(Contract ESA-SC/51-HQ)
(ESA-CR(P)-755) Avail: NTIS HC $5.50

The possibility of using a low weight low power consumption furnace with oxidizing atmosphere at 2000 C for space applications is discussed. The main heating element is made of zirconium oxide with a platinum preheating system. The structure and stabilization of zirconium oxide are detailed together with its application to the space situation. The static and dynamic regimes are discussed with regard to measurement of the resistivity as a function of temperature and dynamic model. The temperature distribution in the furnace and in a main heating element were studied in relation to thermal insulation and weight budget. A model is proposed for optimal control and thermostat using analog simulation. The final concept requires 350 W for an isothermal furnace of 20 mm diameter weighing 3 kg. The cases of temperature gradient furnaces and of universal furnaces are reviewed. ESA

N76-20296# Teledyne Brown Engineering, Huntsville, Ala.
DEVELOPMENT OF A SAFER, MORE EFFICIENT HYDRAULIC-BASED TECHNIQUE FOR RAPID EXCAVATION OF COAL, ROCK, AND OTHER MINERALS Final Report, Jun. 1973 - Mar. 1975
N. E. Chatterton Apr. 1975 100 p
(Contract H0232062)
(PB-245343/9; BM-OFR-75-75) Avail: NTIS HC $5.00 CSCL 08I

Of the 124 tests performed with the excavator, 89 were carried out to evaluate the ability of the excavator to cut in situ rock. Several different particle materials, which ranged from coal to steel shot, were injected; target material consisted of limestone and concrete. The study disclosed that solid particles could be injected into a high-velocity stream without great difficulty at reasonable feed rates and without significant deterioration in the downstream jet. The addition of particles did not appear to improve the cutting ability of the jet as compared to the use of water alone. The cutting ability appeared to increase as the mass of the particle was increased. GRA

N76-20297# Bureau of Mines, Twin Cities, Minn. Mining Research Center.
AUTOMATIC FIRE PROTECTION SYSTEMS FOR LARGE HAULAGE VEHICLES. PROTOTYPE DEVELOPMENT AND IN-MINE TESTING Information Circular 1975
Guy A. Johnson and David R. Forshey 1975 21 p
(PB-246704/1; BM-IC-8683) Avail: NTIS HC $3.50 CSCL 08I

One automatic truck fire protection system protects both the engine compartment and brake grid areas, while the second system is used in the engine compartment/fuel tank area. Both systems have redundant fire-sensing capabilities and manual override controls. Upon sensing flames and/or heat, the systems suppress the fire with pressurized, B-C class dry chemical. Both fire protection systems are flexible in design, and can be modified for use on other mobile mining equipment. Prototypes of both systems were subjected to long-term, in-mine validation testing. Color illustrations were reproduced in black and white. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N76-20298 Stanford Univ., Calif.
ACOUSTIC WAVE SEMICONDUCTOR CONVOLVER APPLIED TO ELECTRICAL AND OPTICAL SIGNAL PROCESSING Ph.D. Thesis
Herve Pierre Renson Gautier 1975 184 p
Avail: Univ. Microfilms Order No. 76-5731

An experimental and theoretical study is presented on the interactions between acoustic surface waves on a piezoelectric insulator and charge carriers in a neighboring semiconductor separated by a small airgap; the application of these phenomena to signal processing and optical imaging was discussed. Although the two media are mechanically isolated, the electric field associated with the surface waves penetrate into the semiconductor and interact with its charge carriers. This interaction is nonlinear and, in the case of two oppositely propagating surface waves, real time convolution is performed. A theory of the convolution interaction, taking into account the possible presence of a depletion, inversion or accumulation layer at the surface of the semiconductor, resulting from a built-in or applied dc field, is presented. Experimental measurements for both n- and p-type silicon on lithium niobate systems are in very good agreement with this theory, and they lead to a technique of measuring the surface state distribution on semiconductors. Dissert. Abstr.

N76-20299 Stanford Univ., Calif.
ON THE CAPACITY OF MULTIPLE-TERMINAL COMMUNICATION NETWORKS Ph.D. Thesis
Aydano Barreto Carleial 1975 195 p
Avail: Univ. Microfilms Order No. 76-5700

A number of problems concerning the capacity of broadcast and multiple access channels are examined. Some results are obtained concerning the M(2N-1)-dimensional capacity region of an interference network that is utilized in a general way. Inner and outer bounds on the corresponding M-dimensional capacity region are obtained for discrete memoryless interference and linear superposition interference channels with additive white Gaussian noise (AWGN); the capacity region is determined in special cases. Results for the channel show that the capacity region does not decrease monotonically as the amount of interfering signal power at the receivers increases. The communication of digital data packets over a multiple-access channel with feedback was studied. It is shown that a previously proposed random time division (Aloha) technique often results in two statistically stable operating points for the system, one with efficient, fast communications and the other with low throughput and high delay. The analysis indicates that acceptable performance can be obtained even when the steady-state performance is very poor. Dissert. Abstr.

N76-20300*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
GEOS-C NONCOHERENT C-BAND TRANSPONDER TEST PROCEDURE FOR SPACECRAFT LEVEL TESTS
A. R. Selser Sep. 1973 25 p
(NASA-TM-X-69363; TK-6340-52) Avail: NTIS HC $3.50 CSCL 17B

Test procedures necessary for the calibration and performance verification of the noncoherent C-band transponders after spacecraft hardware integration, but prior to spacecraft/launch vehicle integration are presented. Author

N76-20301# Transportation Systems Center, Cambridge, Mass.
AIRCRAFT L-BAND BALLOON SIMULATED SATELLITE EXPERIMENTS. VOLUME 1: EXPERIMENT DESCRIPTION AND DATA MODEM TEST RESULTS Final Report, Sep. 1971 - Nov. 1973
Peter D. Engels and Robert A. Wilson Oct. 1975 140 p refs (AD-A017090; DOT-TSC-FAA-74-24-Vol-1; FAA-RD-75-174-Vol-1) Avail: NTIS HC $6.00 CSCL 17/2

The result of an experiment intended to evaluate candidate voice and data modulation systems for use in an L-Band Air Traffic Control System was described. The experiment was designed to evaluate performance in the presence of oceanic multipath, using a high altitude balloon carrying an L-Band transponder as a geostationary satellite simulator. The voice modems chosen were Delta Modulation, Puise Duration Modulation and Adaptive Narrow-Band Frequency Modulation. The data modems used employed PSK modulation with coherent demodulation. Author

N76-20302# Advisory Group for Aerospace Research and Development, Paris (France).
RADIO SYSTEMS AND THE IONOSPHERE
1976 424 p refs In ENGLISH; partly in FRENCH Conf. held at Athens, Greece, 26-30 May 1975
(AGARD-CP-173) Avail: NTIS HC $11.00

The effects of the ionosphere on high frequency communication system are considered. For individual titles, see N76-20303 through N76-20332.

N76-20303 Lincoln Lab., Mass. Inst. of Tech., Lexington.
IONOSPHERIC LIMITATIONS ON THE ANGULAR ACCURACY OF SATELLITE TRACKING AT VHF OR UHF **c17**
J. V. Evans and R. H. Wand *In* AGARD Radio Systems and the Ionosphere 1976 11 p refs Sponsored in part by US Army (For availability see N76-20302 11-32)

The maximum values of the radar metric errors are summarized that are liable to be encountered at 400 MHz at low elevations (2 deg) in the northern United States. The errors will generally be less than the values given here, and all tend to decrease with elevation E although for some (e.g., TIDs) the dependence is weak, and, in the case of scintillation, is controlled principally by the level of magnetic activity. Author

N76-20304 Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AMPLITUDE SCINTILLATION OBSERVATIONS AND SYSTEMS APPLICATION **c17**
Herbert E. Whitney and Jules Aarons *In* AGARD Radio Systems and the Ionosphere 1976 16 p refs (For availability see N76-20302 11-32)

For the design of a transionospheric communications link, scintillation data are to be reduced to statistical descriptions during those intervals for which there is stationariness of the rms fluctuations of the signal. The fade statistics are useful in choosing coding and/or time diversity techniques to overcome this fading. Signal statistics of this type are illustrated using data recorded at equatorial, sub-auroral, and auroral latitudes. These signal statistics are folded into a morphological pattern which contains statistics of scintillation fading as a function of geomagnetic latitude, instantaneous magnetic excursion, and local time. Recent data taken at auroral and sub-auroral latitudes have shown the effects on F layer irregularities of magnetic storms. In particular, the magnetic storms of August 1972 illustrate worst case scintillation levels. Data during the storm of Oct. 31 - Nov. 1, 1973 are used to show the correlation of scintillation with local magnetic variations. Author

N76-20305 Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
SIMULATION AND IMPLEMENTATION OF A MODULATION SYSTEM FOR OVERCOMING IONOSPHERIC SCINTILLATION FADING **c17**
Allen L. Johnson *In* AGARD Radio Systems and the Ionosphere 1976 5 p refs (For availability see N76-20302 11-32)

Ionospheric scintillation has been recognized as a major problem in VHF/UHF satellite communication systems. An extensive computer simulation was done in an attempt to find an economical coding-interleaving combination which could be implemented for an airborne VHF/SHF SATCOM system. A variety of coding techniques were investigated. An actual ionospheric scintillation signal was recorded and digitized for the use in the simulation. The various coding interleaving techniques were played through this simulated channel; the results of each combination were tabulated. It was decided to implement a complete 75 bit-per-second teletype modem utilizing the results of the

simulation. The modem being built utilizes frequency shift keyed modulation. In order to operate the encoder and interleaver, a received data clock is needed. It is derived by sampling the input data and incrementally shifting a reference clock until the best fit is achieved between the reference clock and a number of bits of the incoming data. This data clock is then used for timing the interleaver and encoder. Author

N76-20306 Communications Research Centre, Ottawa (Ontario). Dept. of Communications.

CHANNEL FADING ON AIR MOBILE SATELLITE COMMUNICATIONS LINKS c17

L. A. Maynard *In* AGARD Radio Systems and the Ionosphere 1976 9 p (For availability see N76-20302 11-32)

Statistical measurements of the fading and time dispersion of the earth-space path have been made at locations varying in geomagnetic latitude. These measurements have demonstrated that the required system margins for a given grade of service vary strongly with frequency, geomagnetic latitude, and the way in which system reliability is specified. Preliminary measurements of the multipath characteristics of the North Atlantic show that the reflection process is diffuse. Author

N76-20307 General Electric Co., Schenectady, N.Y. Corporate Research and Development.

TRANSIONOSPHERIC EFFECTS ON RANGE MEASUREMENTS AT VHF c17

Roy E. Anderson *In* AGARD Radio Systems and the Ionosphere 1976 14 p refs (For availability see N76-20302 11-32)

A fully integrated satellite ranging system for locating ships was implemented at VHF. Performance of the system was examined to determine the effects of ionospheric group delay on the accuracy of the position fixes. Several 24-hour periods of ranging from a geostationary satellite to a widespread network of transponders yielded data on diurnal variations in delay and estimates on residual errors when ionospheric models are applied to the measurements. Some data on correlation distances in the ionosphere were obtained. The results suggest that a VHF position fixing system using two geostationary satellites could be operated with an accuracy better than 1 nautical mile when the ionosphere is not disturbed. Author

N76-20308 Army Electronics Command, Fort Monmouth, N.J. Communications/Automatic Data Processing Lab.

PLASMASPHERIC CONTRIBUTION TO GROUP-PATH-DELAY OF TRANSIONOSPHERIC SATELLITE NAVIGATION SIGNALS c17

H. Soicher *In* AGARD Radio Systems and the Ionosphere 1976 15 p refs (For availability see N76-20302 11-32)

A satellite navigation concept requires measurement of the time delay that satellite-emitted signals experience when traversing the distance between satellite and user. A pulse propagating this distance is slowed somewhat by an amount which is directly proportional to the total number of free electrons (TEC) along its path. For high orbit satellites, TEC includes the ionospheric as well as the plasmaspheric electron contents. The Radio Beacon Experiment (RBE) aboard the ATS-6 satellite examined the ionospheric content, N sub I (by the Faraday technique), the total ionospheric and plasmaspheric contents, N sub T (by the group delay technique), and the plasmaspheric content (N sub T - N sub I) = N sub p. Although diurnal, day-to-day, and seasonal variations of N sub p were observed, they were much smaller than corresponding variations of N sub I and N sub T. The ratio of plasmaspheric to ionospheric contents varied diurnally, seasonally, and from day-to-day. The diurnal variation exhibits basically a nearly constant night behavior and a much lower day behavior with rapid changes just after local sunrise and just after local sunset. Author

N76-20309 General Electric Co., Syracuse, N.Y.

IONOSPHERIC RADAR RANGE ERROR CORRECTION BY THE INCOHERENT SCATTER-FARADY ROTATION TECHNIQUE c17

George H. Millman and Glenn M. Reinsmith *In* AGARD Radio Systems and the Ionosphere 1976 13 p refs Sponsored by RADC (For availability see N76-20302 11-32)

The incoherent scatter phenomenon in conjunction with the Faraday effect is evaluated as a technique for near real time correction of ionospheric radar range error. The study was performed utilizing a simulator computer program, the major components of which consisted of a time variant three dimensional electron density model and an earth magnetic field model expressed in terms of a series of spherical harmonics. Theoretical estimates of the Faraday polarization angle and the incoherent backscatter power are made for an assumed high powered radar located in the mid-latitudes with the antenna beam oriented in various azimuth elevation angle configurations. Radar range bias errors derived from the incoherent scatter and Faraday rotation simulated data are compared with the true reference errors. An evaluation is given of the residual range errors, i.e., difference between the predicted and true errors, computed for the months of June and December and sunspot numbers of 10 and 60. Author

N76-20310 National Observatory of Athens (Greece). Ionospheric Inst.

LONG RANGE VHF TRANSEQUATORIAL FOR THE EUROPEAN-AFRICAN PATH, A REVIEW OF TIME DELAY MEASUREMENTS c17

Michael Anastassiadis and George Stefanou *In* AGARD Radio Systems and the Ionosphere 1976 22 p (For availability see N76-20302 11-32)

Five years of measurements of time delay of VHF signals transmitted from Athens and received at Roma (Lesotho) and later at Salisbury and retransmitted by a triggered device back at Athens, support the mechanism of a supermode propagation. The shape of time delay curves during presunset and aftersunset hours are explained on the basis of a simple geometrical model taking into consideration the height of reflecting layers in both hemispheres, the elevation angles, and the central angles between the points of emission and the points of reflections all of which affect the time of propagation of the emitted wave. The influence of thermospheric winds is also considered particularly for the explanation of lengthening during early evening hours. From all above experiments, the exact magnetic conjugancy seems to be of minor importance, and rather large areas surrounding the conjugate point, are regions of high interest, permitting the realization of good communication systems on 30-90 MHz band with a very low peak radiated power. Author

N76-20311 Appleton Lab., Slough (England).

A NEW COMPUTER-BASED METHOD OF HF SKY-WAVE SIGNAL PREDICTION USING VERTICAL-INCIDENCE IONOSONDE MEASUREMENTS c17

P. A. Bradley *In* AGARD Radio Systems and the Ionosphere 1976 16 p refs (For availability see N76-20302 11-32)

A knowledge of ionospheric propagation modes and signal strengths is important for the successful operation of HF point-to-point communication circuits and over-the-horizon radars. Predictions use representations of the state of the ionosphere based either on long term trends in past ionospheric data, or on near real time ionospheric soundings at vertical incidence or over oblique paths. A new prediction scheme is described which can be used with either forecast values or direct measurements of the standard ionospheric characteristics derived from vertical incidence soundings. Its important features include an improved model of the vertical distribution of electron concentration, a homing procedure to determine the rays which travel between specified terminals, an allowance for the focusing of rays with low elevation angles, an expression for ionospheric absorption based on the ionospheric characteristic foE and the inclusion of the effects of polarization coupling loss determined in terms of ray path and magnetic field geometry. Author

N76-20312 Forschungsinstitut der Deutschen Bundespost, Darmstadt (West Germany).

A COMPARISON BETWEEN THE DEUTSCHE BUNDESPOST IONOSPHERIC HF RADIO PROPAGATION PREDICTIONS AND MEASURED FIELD-STRENGTHS

Th. Damboldt *In* AGARD Radio Systems and the Ionosphere 1976 18 p refs (For availability see N76-20302 11-32)

The Deutsche Bundespost makes long term propagation predictions for use by its own frequency planning department and for various other users. The forecast computer program is reported, followed by an outline of field strength measurements. Afterwards the measurements are compared with the forecasts.

Some of the deviations between forecasts and measurements are analyzed. Author

N76-20313 Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
SWEEP FREQUENCY PROPAGATION ON AN 8,000 km TRANSEQUATORIAL NORTH SOUTH PATH
H. G. Moeller *In* AGARD Radio Systems and the Ionosphere 1976 7 p refs (For availability see N76-20302 11-32)

Two prediction improvements are suggested according to sweep frequency observations between Tsumeb, South West Africa and West Germany. In summer daytime the observed MOF is up to a factor of two higher than the predicted MUF. This error can be reduced to a factor of 1.2 if an Es-transmission factor of 7 is applied instead of a factor of 5 which had been used hitherto. In the existing predictions for long distance medium wave propagation only E-layer reflections are taken into account. In contrast to this assumption strong F-layer reflections have been observed. The median F-layer LOF was 1.3 MHz after midnight. At these low frequencies, signals reflected at the E-layer were quite often weaker than the signals reflected at the F-layer. Author

N76-20314 GEC-Marconi Electronics Ltd., Chelmsford (England). Research Lab.
AN IONOSPHERIC STORM MODEL USED FOR FORECASTING
L. W. Barclay *In* AGARD Radio Systems and the Ionosphere 1976 5 p refs (For availability see N76-20302 11-32)

Long term, monthly or seasonal, predictions are prepared in advance for both point to point and mobile communications requirements. Such predictions are intended to be used for planning and for contingencies and are not intended as an accurate guide for day to day operation. Forecasts prepared a few hours in advance and distributed rapidly can be used to inform the operators how the operational frequency band on a particular day differs from that shown in the long term predictions. The relationship between solar events and radio communication frequencies is incorporated in an ionospheric storm model in order to produce an acceptable forecast from the data received. Author

N76-20315 Barry Research Corp., Sunnyvale, Calif.
TECHNIQUES FOR REAL-TIME HF CHANNEL MEASUREMENT AND OPTIMUM DATA TRANSMISSION
George Barry and Robert B. Fenwick *In* AGARD Radio Systems and the Ionosphere 1976 10 p (For availability see N76-20302 11-32)

The time variability of path loss, noise, interference, and dispersion which characterize an HF channel can be overcome by adding three elements to the conventional communication system: (1) a transmission test set; (2) an interference monitor; and (3) high order time diversity. The transmission test set continuously monitors the circuit loss and multipath, 3-30 MHz. The optimum operating frequency is obvious from the test set display, but the specific frequency must be selected from among the allocated choices on the basis of interference. The interference monitor measures and stores the percentage occupancy of all HF channels and the operating frequency is chosen from the monitor display. Although a clear, propagating frequency is selected, noise and fading cause data transmission errors; the most effective solution is high order time diversity. Author

N76-20316 Admiralty Surface Weapons Establishment, Portsmouth (England).
CHANNEL ESTIMATION TECHNIQUES FOR HF COMMUNICATIONS
M. Darnell *In* AGARD Radio Systems and the Ionosphere 1976 11 p refs (For availability see N76-20302 11-32)

Channel estimation is a term used to describe the process of monitoring and measuring selected parameters of a communications channel with the aim of describing quantitatively the absolute or relative states of a given set of communications channels. This information can then be employed to optimize use of the dispersive, time variable HF propagation medium. The paper discusses the philosophy and applications of estimation techniques. Three basic classes of channel estimation systems are defined and the most important practical implementations of these basic classes are described. Author

N76-20317 Societe Telecommunications Radioelectriques et Telephoniques (France).
SELECTION TECHNIQUE OF THE OPTIMAL FREQUENCY FOR DATA TRANSMISSION THROUGH THE IONOSPHERE [PROCEDE DE SELECTION DE LA FREQUENCE OPTIMALE POUR UNE TRANSMISSION DE DONNEES SUR CANAL IONOSPHERIQUE]
G. David, C. Goutelard (Laboratoire d'Etude des Transmissions Ionospheriques), and J. P. VanUffelen *In* AGARD Radio Systems and the Ionosphere 1976 15 p refs In FRENCH (For availability see N76-20302 11-32)

A technique was described by which the reception conditions for a radio-electric channel, preselected according to an operational sequence, may be assured to be satisfactory. Criteria are given by which a test sequence may be transmitted and analyzed following its reception. The relationship of the stations and their operating mode in centralized networks was then given, based on information received from an ionosonde; a discussion of decentralized networks with a reduced number of stations was also given. Transl. by Y.J.A.

N76-20318 Southampton Univ. (England).
REAL-TIME HF CHANNEL ESTIMATION BY PHASE MEASUREMENTS ON LOW-LEVEL PILOT TONES
J. A. Betts and M. Darnell (ASWE, Portsdown, Engl.) *In* AGARD Radio Systems and the Ionosphere 1976 12 p refs (For availability see N76-20302 11-32)

The principles of a method of real time channel estimation based upon measurements of the phase perturbations imposed on a low level pilot tone by the HF propagation path are described. Results of three sets of trials carried out over short, medium and long range HF paths in order to verify the theoretical basis of the technique are then presented. Consideration is also given to possible future development of the technique and three operational scenarios in which this type of channel estimation might be applied are discussed. Author

N76-20319 GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.
SHIP-SHORE COMMUNICATION AT SHORT RANGES
L. W. Barclay *In* AGARD Radio Systems and the Ionosphere 1976 15 p refs (For availability see N76-20302 11-32)

Communication between ship and shore, when the ships are sailing in coastal waters, is usually conducted in the VHF band for very short ranges and at MF and low HF frequencies, up to say 4 MHz, for ranges up to several hundred miles. MF propagation is essentially by the ground wave mode but the addition of sky wave modes at night increases the potential coverage area, increases the interference levels in the MF band and creates an interference zone where the ground and sky waves are of comparable amplitudes. The ground wave propagation mode is assessed by taking account of system parameters, of propagation and noise characteristics and of the distance of the shore station from the coast. The optimum frequency for ground wave communication, for a particular system is indicated. The effect of sky wave propagation on the conclusions reached is also discussed. The results of some experimental work are presented which show that, for communication quality SSB telephony, operation may be extended through the fading zone. Author

N76-20320 Naval Research Lab., Washington, D.C.
NARROWBAND HF COMMUNICATION SYSTEMS FOR DIGITAL VOICE
W. Jewett and R. Cole *In* AGARD Radio Systems and the Ionosphere 1976 13 p refs (For availability see N76-20302 11-32)

Source encoding techniques for narrowband digital voice generate a number of PCM symbols that represent different weight functions. The relative weights of the bits/symbols are considered in the optimization of the communication circuit. This minimizes the effect of transmission errors on the synthesized speech. Thus, the channel encoding selectively adds redundancy to the signal to maximize protection to portions of the digital source signal. This is the approach that is being followed to determine the

optimum characteristics for a voice processor/HF modem.
Author

N76-20321 Thomson-CSF, Gennevilliers (France).
HF TRANSMISSION OF NUMERICAL DATA [TRANSMISSIONS NUMERIQUES SUR VOIES HF]
C. Dechaux and J. M. Lebidois *In* AGARD Radio Systems and the Ionosphere 1976 16 p In FRENCH; ENGLISH summary (For availability see N76-20302 11-32)

In the field of digital transmissions, the major characteristic of the ionosphere is that it behaves as a multipath propagation medium. This paper describes a type of 1,200 bits/s - MODEM fitted to that kind of transmission medium and which is to be used for SSB radio transmission. After a short introduction about data transmission on HF channels, the MODEM operation mode and its implementation are reviewed; to conclude, the MODEM real life experiment results are discussed. Author

N76-20322 Manchester Coll. of Science and Technology (England). Dept. of Electrical Engineering and Electronics.
IMPROVEMENTS TO HF FSK DATA TRANSMISSION
Geoffrey F. Gott and Brian Hillam *In* AGARD Radio Systems and the Ionosphere 1976 7 p refs (For availability see N76-20302 11-32)

An FSK signal keyed at 75 bauds, with 850 Hz frequency shift, can have one of several frequency allocations within any given 2.4 KHz voice channel. In the presence of interference from other users, or slow selective fading, the FSK system performance may be significantly improved by using a frequency allocation appropriate to the prevailing channel conditions. This paper reports on an 800 km HF link experiment which investigated this principle, with a view to improving air/ground data transmission. Author

N76-20323 Admiralty Surface Weapons Establishment, Portsdown (England).
ADAPTIVE SIGNAL SELECTION FOR DISPERSIVE CHANNELS AND ITS PRACTICAL IMPLICATIONS IN COMMUNICATIONS SYSTEM DESIGN
M. Darnell *In* AGARD Radio Systems and the Ionosphere 1976 14 p refs (For availability see N76-20302 11-32)

Possible techniques are considered whereby the operation of an HF communications system could be made adaptive in response to the state of the channel. Adaptive RF equipment, source encoding/decoding and channel encoding/decoding procedures are described and their interactions discussed. Adaptive signal selection implies adaptive signal generation and processing equipment. Possible formats for such units are outlined, together with the inputs required for their operation and the advantages accruing from their use. Author

N76-20324 Societe Telecommunications Radioelectriques et Telephoniques (France).
DESCRIPTION OF A SELF-ADAPTIVE SYSTEM FOR DATA TRANSMISSION THROUGH THE IONOSPHERE [DESCRIPTION D'UN DISPOSITIF AUTOADAPTIVE POUR TRANSMISSION DE DONNEES SUR LIAISONS IONOSPHERIQUES]
J. P. VanUffelen *In* AGARD Radio Systems and the Ionosphere 1976 13 p refs In FRENCH (For availability see N76-20302 11-32)

A data transmission system in which distortions due to ionospheric propagation are corrected by a self-adaptive equalizer was described. More specifically, a description of the equalizer is given, whose adjustment is performed continuously from the received signals. A data transmission system with a capacity of 1,200 bauds and conceived with the self-adaptive filter was tested over a distance of 2,500 km. Measurement results obtained in the laboratory and in the field are given. Transl. by Y.J.A.

N76-20325 Centre National d'Etudes des Telecommunications, Lannion (France).
FEASIBILITY STUDY OF A HF ANTENNA WITH ELLIPTICAL POLARIZATION USED FOR TELEGRAPHIC TRANSMISSION WITH VERY HIGH SPEED [POSSIBILITES DE REALISATION ET D'EMPLOI D'UNE ANTENNE A POLARISATION ELLIPTIQUE DANS LA BANDE H. F. POUR UNE LIAISON A GRANDE VITESSE TELEGRAPHIQUE]
R. Hanbaba and J. C. Zehren *In* AGARD Radio Systems and the Ionosphere 1976 18 p refs In FRENCH (For availability see N76-20302 11-32)

The design of an HF antenna radiating, in a given direction, a wave with elliptical or circular polarization was considered. The radiating system consists of two intersecting half-wave dipoles with an angle 2 beta between them, and located in a plane inclined at an angle alpha to the vertical. The effect of the finite permittivity of the ground on the directivity diagram was analyzed, and the gain was computed with the type of polarization considered. The feasibility of obtaining an elliptical polarization with a fixed vector orientation was then studied as a function of the current fed to each dipole. Finally, a numerical application was presented for a frequency of 10 MHz, including the computation of the soil coupling impedances. Transl. by Y.J.A.

N76-20326 Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany).
INFLUENCE OF SPREAD-F ON HF RADIO SYSTEMS
J. Roettger *In* AGARD Radio Systems and the Ionosphere 1976 19 p refs (For availability see N76-20302 11-32)

Fading power spectra and amplitude distributions of trans-equatorial HF signals are evaluated. The special type of ionospheric transhorizon radar which is applied for these investigations locates side reflecting spread-F irregularities in the equatorial ionosphere. By means of the digitized data, the characteristics of TEP signals, which are strongly influenced by the side reflecting equatorial spread-F irregularities, are determined. Considerable pulse dispersion is observed. Strong flutter fading is evident during spread-F conditions. The fading power spectrum and the amplitude distribution of the TEP signals is calculated from the observational data and matched to a Nakagami-Rice distribution. The parameters obtained from this data reduction state that strong electron density gradients in the irregularities give rise to side reflection of HF signals. Effective radar cross sections and the mean conservation time of irregularity structures are calculated from the amplitude evaluation. Author

N76-20327 Laboratoire d'Etude des Transmissions Ionospheriques, Cachan (France).
APPLICATION OF PSEUDO-ORTHOGONAL CODES TO TRANSMISSION THROUGH THE IONOSPHERE [UTILISATION DE CODES PSEUDO-ORTHOGONAUX ADAPTES AUX TRANSMISSIONS IONOSPHERIQUES]
F. Chavand, M. Gindre, and C. Goutelard *In* AGARD Radio Systems and the Ionospere 1976 24 p refs (For availability see N76-20302 11-32)

The application of pseudo-orthogonal codes to signal transmission through the ionosphere was considered so that the receiver characteristics need not be modified permanently as a function of the transmission parameters. The pseudo-orthogonality of these codes was defined and discussed. The code parameters were determined from the propagation characteristics and their random variations. An optimization technique was used in this regard, taking into account the propagation and receiving conditions. Families of codes were obtained and their validity confirmed by experimental results. The data rate that may be reached corresponds, in some cases, to a gain of 25, with a better protection against disturbances and allowance for error corrections. Transl. by Y.J.A.

N76-20328 Lincoln Lab., Mass. Inst. of Tech., Lexington.
POLAR IONOSPHERE MODELING BASED ON HF BACKSCATTER, BEACON, AND AIRBORNE IONOSONDE MEASUREMENTS
B. J. Burdick, J. H. Chisholm, and B. E. Nichols *In* AGARD Radio Systems and the Ionosphere 1976 18 p refs Sponsored by ARPA (For availability see N76-20302 11-32)

An experiment to investigate the polar ionosphere was undertaken during the period November 1971 through November 1972 with an HF radar stationed in Northern Maine, U.S.A. operating on a regular schedule collecting backscatter data over a 90 deg azimuthal sector of the polar ionosphere and monitoring beacons located at Keflavic, Iceland and at Thule and Narsarssuaq, Greenland. From this data base, a daytime and a nighttime period were selected for ionospheric modeling and raytracing analysis. The structure of the nighttime ionosphere was determined from simultaneous radar, beacon and airborne

ionosonde measurements and was found to include the F-layer trough, plasma ring and auroral E-layer. On the basis of the radar backscatter and beacon data alone, the structure of the daytime ionosphere was found to be consistent with a one dimensional model. Author

N76-20329 Paris Univ. (France).
OBSERVATION OF IRREGULARITIES IN THE SUB-AURORAL F REGION OF THE IONOSPHERE THROUGH A BACKSCATTER TECHNIQUE AND A MID-LATITUDE STATION [OBSERVATION AU MOYEN DE LA TECHNIQUE DE RETRODIFFUSION ET A PARTIR D'UNE STATION DE MOYENNE LATITUDE DES IRREGULARITES DE LA REGION F SUB AURORALE]
A. Bourdillon *In* AGARD Radio Systems and the Ionosphere 1976 14 p refs In FRENCH (For availability see N76-20302 11-32)

A.H.F. backscatter sounder located at Valensole (44 deg N; 6 deg E), coupled to a wide band highly directive antenna with a capacity of six discrete radiating directions on each side of the geographic north, recorded in 1972 and 1973 frequent occurrence at night of irregularities located in the high latitude ionsophere (latitude = 55-65 degrees). Interpretation of the data using ray tracing techniques showed that field aligned irregularities often occurred simultaneously at low altitudes (240-280 km) and above the F region maximum (340-400 km). A swept azimuth recording is produced showing at a given time a wide extension in range of the irregularities. A series of recordings was made under conditions of high magnetic activity, showing a displacement towards the equator of the zones of occurrence of irregularities. The displacement is about 2.1 degrees in latitude per unit Kp. Author

N76-20330 Oslo Univ. (Norway).
FORMATION AND MOVEMENTS OF IONOSPHERIC IRREGULARITIES IN THE AURORAL E-REGION
Alv Egeland *In* AGARD Radio Systems and the Ionosphere 1976 15 p refs (For availability see N76-20302 11-32)

The auroral E-region undergoes more or less continuous, unpredictable, structural ionization changes of almost all scales of size and time. These ionospheric irregularities, with rapid motions and oscillations, are superimposed on the large scale, long term variations in the medium. The irregularities will change the propagation conditions and degrade radio communication and radar performance. The ionization structures also upset the delicate energy balance in the upper atmosphere by changing almost every parameter which specifies normal conditions. Formation and movements of small scale irregularities in the auroral E-region are reviewed. A variety of instability concepts, which may explain the production of ionization irregularities, have been postulated. Some of these will be mentioned and compared with recent ground and in-situ measurements. In addition, macroscopic drift motions in the E-region of ionization irregularities will be summarized. Author

N76-20331 Communications Research Centre, Ottawa (Ontario).
HIGH RESOLUTION MEASUREMENTS OF TIME DELAY AND ANGLE OF ARRIVAL OVER A 911 km HF PATH
D. W. Rice *In* AGARD Radio Systems and the Ionospere 1976 15 p refs (For availability see N76-20302 11-32)

The results of some 40 hours of afternoon and evening measurements of HF propagation over a 911 km path are presented. An FMCW sounding technique was employed with a linear receiving array of 1.2 km aperture. These arrangments made it possible to resolve modes differing in time of arrival by as little as 20 microseconds, and to determine the angle of arrival of each mode. The results show that markedly nonlinear phase fronts can occur even for apparently single modes of propagation, as a result of the irregular structure of the ionosphere which splits the signal into a number of sub-modes. This finding presents a possible limitation to the accuracy of HF direction-finding, which applies even to systems capable of resolving the modes. Author

N76-20332 Leicester Univ. (England). Physics Dept.
THE CORRECTION OF ERRORS IN HF DIRECTION FINDERS BY TRAVELLING IONOSPHERIC DISTURBANCES
T. B. Jones and C. T. Spracklen *In* AGARD Radio Systems and the Ionosphere 1976 9 p refs (For availability see N76-20302 11-32)

Traveling ionospheric disturbances (TIDs) produce changes in the bearing of the signals received from a distant transmitter via the ionosphere. By monitoring the Doppler frequency shifts in the reflected signal at three or more receiving sites the speed, direction and magnitude of the TID can be determined. If the Doppler frequency shift at the direction finder is also measured, the displacement of the reflection point and hence the bearing deviation produced by the TID can be calculated. A very considerable improvement in accuracy is obtained when such corrections are applied to signals propagated over an 850 km path. Author

N76-20333# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
LIDAR TECHNOLOGY AND APPLICATION
Christian Werner 29 Jul. 1975 59 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-75-14) Avail: NTIS HC $4.50; DFVLR, Cologne DM 20.70

The theory of the method is discussed in relation to the scattering of the atmosphere. Additional system parameters are discussed. Some experimental results are given for using lidar in meteorology and environmental protection. Author (ESA)

N76-20334# GTE-Telecomunicazioni S. p. A., Cassina de Pecchi (Italy).
TECHNICAL AND ECONOMIC STUDY OF A DOMESTIC OR COMMUNITY 12GHz BAND SATELLITE BROADCAST RECEIVER Final Report
Jun. 1975 33 p
(Contract ESA-SC/60-HQ)
(ESA-CR(P)-766) Avail: NTIS HC $4.00

The receiver was analyzed from technical and economical viewpoints. TV and sound signal transmission from satellite transponders were studied in order to determine the major problems in receiver design and to propose signal transmission techniques optimal to both satellite utilization and receiver complexity. Two solutions were considered for the receiver utilizing a low noise image rejection mixer and a field effect transistor amplifier, respectively. The economic analysis is based on an investigation of device and system costs. ESA

N76-20335*# Liege Univ. (Belgium). Dept. of Electrical Measurements.
OPTIMUM QUANTISERS FOR A GAUSSIAN INPUT PROBABILITY DENSITY AND FOR THE MAGNITUDE-ERROR DISTORTION MEASURE
J.-C. Demaret Paris ESA Jun. 1975 27 p refs Sponsored in part by ESRO and NASA
(NASA-CR-145825; ESA-SM-83) Avail: NTIS HC $4.00 CSCL 17B

The parameters of non-uniform and uniform quantizers up to ten bits of quantization, optimum for a Gaussian input probability and for the magnitude-error distortion criterion are computed. Optimum quantizers must be understood as quantizers with minimum distortion. The numerical method used for the optimization converges relatively rapidly. The comparison between optimum non-uniform quantizers and optimum uniform quantizers is made. Author (ESA)

N76-20336# Centre National d'Etudes Spatiales, Toulouse (France).
EXPERIMENTAL STUDIES OF MULTIPATH PROPAGATION AT 400 MHz [ETUDES EXPERIMENTALES DES TRAJETS MULTIPLES A 400 MHz]
Jean-Francois Dulck and Andre Ribes Jul. 1975 53 p In FRENCH; ENGLISH summary
(CNES-NT-21) Avail: NTIS HC $4.50

An experimental radio link was set up between a seaborne transmitter (buoy) and a ground receiver situated on a coastline at approximately 310 m altitude in order to simulate effects of multipath propagation caused by the sea surface on the sea-to Meteosat satellite data link. One experiment was carried out with unmodulated waves to determine the fading margin necessary

to overcome power losses due to multipath effects. Another experiment, carried out with modulated waves, was intended to compare the performance of different modulation methods and coding schemes to select the ones least sensitive to multipath perturbations. It was found that the sea surface behaves like a reflecting mirror at 400 MHz. The necessary additional transmitting power was found to vary from 5 db to 1db according to the view angle of the receiving antenna. For modulated waves (PCM, PS12, FSK and Viterbi coding), the bit error probability was found to be unaffected by power fluctuations caused by sea surface irregularities. ESA

N76-20337# Centre National d'Etudes Spatiales, Toulouse (France).
ANTENNA OPTIMIZATION IN THE PRESENCE OF STABILIZATION ERRORS. PROGRAM USER MANUAL [OPTIMISATION D'ANTENNE EN PRESENCE D'ERREURS DE STABILISATION. MANUEL D'UTILISATION DU PROGRAMME]
Claude Quere Jan. 1976 50 p refs In FRENCH; ENGLISH summary Supersedes Rept-74/81/CT/MA/EM
(CNES-NT-26; Rept-74/81/CT/MA/EM) Avail: NTIS HC $4.00

A program is described for calculating dimensions and orientation of a satellite antenna which minimizes the power to be radiated to ground in such a way that the received level is higher than a given threshold value. Errors in satellite attitude are taken into account in this optimization. The antenna radiation pattern is approximated by an elliptical paraboloid. ESA

N76-20338# Advanced Technology Center, Inc., Dallas, Tex.
A STUDY OF ELECTROMAGNETIC WAVE INTERACTIONS WITH AIR PLASMAS Final Report, 15 Dec. 1972 - 30 Jan. 1975
William H. Rudderow Jul. 1975 104 p refs
(Contract F19628-73-C-0140; AF Proj. 4642)
(AD-A016449; ATC-B-94300/5CR-28; AFCRL-TR-75-0418) Avail: NTIS CSCL 20/14

An experimental study was performed to study the effect of thin plasma layers upon the transmission characteristics of low and high power microwave transmission. A high performance shock tube using dry air as the test gas was used to generate the plasma. Plasma conditions were established to simulate the reentry environment encountered during the terminal phases of a slender reentry vehicle. Flush mounted X band waveguide aperture antennas or special H-plane horn antennas were used to launch and detect the microwave signals. Thin plasma layers were cut from the shock-generated plasma using sharp-edged ground planes mounted inside the shock tube. Initial shock tube pressures were established at 5.0 torr or 10.0 torr while the shock velocities were varied to produce electron densities of 10 to the 11th power - 10 to the 14th power/cu. cm. Diagnostic measurements were performed with various flush mounted electrostatic probes, stagnation point electrostatic probe, and supporting static pressure gages. GRA

N76-20339# Michigan Univ., Ann Arbor. Radiation Lab.
A STUDY OF AXIAL SLOT ARRAYS ON A CIRCULAR CYLINDER FOR USE ON ELECTRICALLY SMALL VEHICLES Final Report, 15 Sep. 1974 - 30 Jun. 1975
Dipak L. Sengupta and Joseph E. Ferris Sep. 1975 67 p refs
(Contract F19628-75-C-0036; AF Proj. 5635)
(AD-A016564; UMICH-013367-1-f; AFCRL-TR-75-0466) Avail: NTIS CSCL 09/5

Radiation patterns produced by arrays of axial slots on a conducting cylinder are studied theoretically and experimentally to develop directive antenna systems for use on electrically small aircraft or missiles. The design of the array is mainly governed by the considerations of required field discriminations between various directions. A method has been developed for the design of a reduced-height waveguide cavity-backed slot which can be used as an individual radiating element of the array. Impedance and radiating properties of the slot element are studied and discussed. GRA

N76-20340# Cincinnati Electronics Corp., Ohio.
RADIO SET AN/PRC-70( ) Quarterly Report, 1 Jan. - 31 Mar. 1975
C. A. Bucher Aug. 1975 69 p refs
(Contract DAAB07-71-C-0319; DA Proj. 1S6-674701-D-535)
(AD-A016937; ECOM-0319-9-71; Rept-80045-PRC41/875; QR-9) Avail: NTIS CSCL 17/2

The report present data from acceptance tests made at room temperature. GRA

N76-20341# Mitre Corp., Bedford, Mass.
AN OUTLINE OF THE APPLICATIONS SOFTWARE FOR THE RIDS EXPERIMENTAL TDM BUS
P. R. Cloud L. G. Hanscom Field, Mass. ESD Sep. 1975 36 p ref
(Contract F19628-75-C-0001; AF Proj. 6370)
(AD-A016489; MTR-3015; ESD-TR-75-78) Avail: NTIS CSCL 17/2

Under the Radio Information Distribution System (RIDS) project a rudimentary experimental TDM bus was built that is compatible with the constraints of MIL-STD-1553 (USAF). The report outlines the applications software generated in support of a demonstration of some of the bus capabilities. These included the servicing of an AN/ARC-50 UHF radio and an array of cockpit indicators, initiation of visual and audible warnings based on the values of the parameters being monitored and displayed, and the generation of fault diagnostic displays when an operator makes an illegal switch setting. GRA

N76-20342# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
INVESTIGATION OF RADAR RAIN CLUTTER CANCELLATION USING A POLARIZATION METHOD Final Technical Report, 16 Oct. 1973 - 31 Dec. 1974
R. W. Rice and Peyton A. Peebles Griffiss AFB, N. Y. RADC Aug. 1975 158 p refs
(Contract F30602-74-C-0037; AF Proj. 4506)
(AD-A016439; RADC-TR-75-126) Avail: NTIS CSCL 17/9

The work considers a new polarization method for possible reduction of rain clutter in monostatic radar. Basically, the proposed technique attempts to adjust the effective polarization of the receiver to match the average polarization of backscattered fields to improve the cancellation attainable from systems ordinarily using circular polarization. GRA

N76-20343# IIT Research Inst., Annapolis, Md.
COMMUNICATIONS/ELECTRONICS RECEIVER PERFORMANCE DEGRADATION HANDBOOK (SECOND EDITION) Final Report
Frank Kravitz and Michael Lemke Aug. 1975 254 p refs Supersedes ESD-TR-73-014
(Contract F19628-75-C-0002; AF Proj. 649E)
(AD-A016400; ESD-TR-75-013; ESD-TR-73-014) Avail: NTIS CSCL 17/2

The revised Receiver Performance Degradation Handbook provides reference curves for determining receiver performance as a function of input signal-to-interference ratio. The performance degradation curves were obtained using both measured data and simulation models. The desired-signal modulation types considered are A1, A2, A3, A3J, A5C, A7J, A9B, F1, F3, F9 and P9. The interference modulation types are A1, A3, A3J, A5C, A9B, F1, F3, F9, P0 and noise. GRA

N76-20344# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MEASUREMENT OF ELF NOISE PROCESSING
Andrew S. Griffiths 2 Sep. 1975 69 p refs Sponsored in part by Navy
(Contract F19628-76-C-0002)
(AD-A016477; TN-1975-33; ESD-TR-75-171) Avail: NTIS CSCL 17/2

The report describes non-linear processing experiments with ELF noise recorded in Norway, Saipan, and Greece. Effective noise levels, an important measure of performance for a non-linear receiver, were computed using sine-wave signals in the 42-48 Hz and 72-78 Hz bands. Although results were not optimum due to fixed (as opposed to adaptive) clip levels, notch filter effects and local sine-waves interference, they do show diurnal variations and do provide a significant increase in the available data in this frequency range. GRA

N76-20345# American Nucleonics Corp., Woodland Hills, Calif.
LF FIELD MEASUREMENTS AND NOISE SUPPRESSION Final Report, 15 Oct. 1974 - 30 Jun. 1975
Walter A. Sauter and Rabindra N. Ghose 1 Jul. 1975 53 p
(Contract F19628-75-C-0028; AF Proj. 4603)
(AD-A016562; ANC-1051-R1; AFCRL-TR-75-0369) Avail: NTIS CSCL 17/2

Requirements toward the measurement of LF fields at TE and TM modes originating from a trailing wire antenna and received at a distant aircraft including means to suppress noise to permit discernibility of signals, are reported herein. Comparative field tests for the TE and TM modes indicate that the air-to-air long-range LF communication effectiveness can be significantly improved if the TE mode field is utilized at the receiver. The advantages obtainable from the TE mode field, however, cannot be fully realized unless the noise at the receiving antenna is suppressed from its normal level. Means to suppress 400 Hz harmonic noise, in general, and the use of the interference cancellation system in particular including experimental verification of its potential advantages, are outlined in the report. GRA

N76-20346# Pacific Sierra Research Corp., Santa Monica, Calif.
VLF/LF TE-MODE PROPAGATION UNDER DISTURBED IONOSPHERIC CONDITIONS Final Report, 1 May - 30 Jun. 1975
Edward C. Field and Michael A. Dore Jul. 1975 59 p refs
(Contract F19628-75-C-0181; AF Proj. 616A; AF Proj. 6781)
(AD-A016527; PSR-504; AFCRL-TR-75-0382) Avail: NTIS CSCL 17/2

The report compares calculated attenuation rates for transverse magnetic (TM) and transverse electric (TE) modes propagating in the earth-ionosphere waveguide. Frequencies from 10 to 50 kHz are considered, and attention is restricted to situations where the fields can be represented in terms of the least-attenuated TM or TE mode. Nine model ionospheres corresponding to conditions caused by widespread high-altitude fission debris are used as inputs to the calculations. Certain of these models are also representative of polar-cap-absorption (PCA) events. The calculations utilize full-wave methods, and account for the vertical inhomogeneity of the ionosphere, the effects of heavy ions, and the curvature of the earth. In addition to the modal attenuation rates, results are given for field-strength height-profiles, plane-wave ionospheric reflection coefficients, and the relative importance of heavy ions vis-a-vis electrons. GRA

N76-20347# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
ELECTRONIC SENSOR PACKAGE AND DATA TRANSMISSION SYSTEM FOR PROJECT TELEPLANE Final Report, 3 Jan. - 31 Jul. 1974
Kenneth E. Ayers Aug. 1975 36 p
(AD-A016480; AFAL-TR-74-252) Avail: NTIS CSCL 17/2

A functional and detailed description is given of an electronic data system to be used in a Remotely-Piloted-Vehicle (RPV) test environment. It includes descriptions of a basic electronic sensor package; a digital data transmission system and its signal structure; and an associated receiving/decoding scheme. GRA

N76-20348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSENSITIVITY OF DATA TRANSMISSION SYSTEMS WITH FEEDBACK TO BURST NOISE
A. Karczmarewicz 30 Jan. 1975 21 p refs Transl. into ENGLISH from Rozprawy Elektrotech. (Poland), v. 16, no. 3, 1970 p 507-516
(AD-A017191; FTD-HC-23-0613-75) Avail: NTIS CSCL 17/2

The insensitivity to burst noise of some well-known data transmission systems with feedback is analysed. The criterion of this analysis is the earlier described measure of insensitivity of systems to burst noise based upon the analysis of system behavior during black-out. The cases when only the main channel is affected by the noise, only the feedback channel and both channels simultaneously, are considered. Numerical examples are given. GRA

N76-20349# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT AN/FRC 162 TEST Interim Report
Edward F. New 30 Sep. 1975 41 p refs
(AD-A017015; CCC-CED-75-DTEP-006) Avail: NTIS CSCL 17/2

The Collins Radio AN/FRC 162 radio was tested in back-to-back configuration for determination of transfer parameters and to develop standard test techniques. The radio operates at a baseband rate of 12.5526 Mb/s (192 voice channels) in a 14 MHz bandwidth in the 8 GHz band. BER vs RSL characteristics are displayed as the primary mode of equipment evaluation. Carrier-to-interference data, switching errors, and, baseband repeater operation data are presented. Power spectra are displayed showing 99% power bandwidth points and masks for the FCC emission limitations. The BER vs RSL does not deviate greatly from theoretical limits. Spectra emissions would violate 14 MHz digital limitations, if required. Resistance to co-channel interference is better than the adjacent channel interference which causes unacceptable REB performance at low C/I ratios. Results of switching performance shows conformance to specifications. Baseband repeater operation yields a BER performance 10 times worse than one-hop operation. GRA

N76-20350# Army Communications-Electronics Engineering Installation Agency, Fort Huachuca, Ariz.
DIGITAL TRANSMISSION EVALUATION PROJECT: 23P2B SENSOR LOGIC SWITCH Final Report
Edward F. New 15 Sep. 1975 21 p refs
(AD-A017016; CCC-SR-75-DTEP-009) Avail: NTIS CSCL 17/2

The Collins Radio 23P2B sensor logic switch was tested as installed in the AN/FRC-162 receivers in active link configuration. The make-before-break technique was designed to produce error-free switching in manual and automatic modes. One-hop transmissions, two-hop transmissions with data regeneration, and two-hop transmission without data regeneration tests were performed. Baseband attenuation baseband time delay, RF attenuation, and differential RSL's were studied for effects on multiplexer errors and reframes. The switch performed error-free under normal conditions at both high and low RSL's. Tolerances for normal operation are specified. GRA

N76-20351# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE USE OF FINITE FIELDS AND RINGS TO COMPUTE CONVOLUTIONS
Irving S. Reed 6 Jun. 1975 26 p refs
(Contract F19628-73-C-0002; ARPA Order 2006)
(AD-A016955; TN-1975-50; ESD-TR-75-241) Avail: NTIS CSCL 09/4

This note extends briefly the integer transforms of C.M. Radar (1972) to transforms over finite fields and rings. These transforms have direct application to digital filters and make possible digital filtering without round-off error. In some cases, the parameters of such number-theoretic transforms can be chosen so that substantial reductions in hardware are possible over what would be needed using classical digital filtering techniques. GRA

N76-20352# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SURFACE ACOUSTIC WAVE FILTERS AT UHF: DESIGN AND ANALYSIS Physical Sciences Research Papers
Andrew J. Slobodnik, Jr. 3 Jun. 1975 680 p refs
(AF Proj. 634B)
(AD-A017106; AFCRL-TR-75-0311; AFCRL-PSRP-634) Avail: NTIS CSCL 09/5

The purpose of the report is to provide a unified and reasonably self-contained source of theoretical techniques for ideal Surface acoustic wave (SAW) bandpass filter design and analysis. Topics discussed include an introduction to sampling theory, transducer analysis from sampling weights, cosine squared-on-a-pedestal transducers, phase reversal transducers, Dolph-Chebyshev and Kaiser weighting for sharp-cutoff filters, optimum (equiripple) filter synthesis plus Butterworth and other no-null frequency response filters. In addition, periodic time and frequency responses are discussed. Synthesis of phase weighted bandpass filters are also considered in detail, as are second order and real life effects such as inaccurate apodization, inaccurate finger placement, electrode resistance effects, and phase distortion due to the finite gap between electrodes and dummy electrodes. In all

cases, full computer program descriptions, listings and test runs are provided. GRA

N76-20353# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RADIATION PROPERTIES OF A SPHERICAL ARRAY DESIGNED FOR LOW SIDELOBES
Joseph T. Mayhan 30 Sep. 1975 59 p refs
(Contract F19628-76-C-0002; AF Proj. 1511)
(AD-A017278; TN-1975-46; ESD-TR-75-276) Avail: NTIS CSCL 09/5

The sidelobe properties of a spherical conformal array are considered in detail. The outer sidelobe behavior of the array, governed by the grating lobes generated due to the array symmetry, is shown to be very sensitive to aperture illumination, and increases considerably as one tapers the aperture illumination for low near-in sidelobes. The grating lobes appear in the peculiar manner due to the symmetries inherent in the icosahedron geometry, and the rotational symmetry of the array results in a multiplication of the number of grating lobe planes occurring for the conventional planar array. The effects of random errors in the element positioning have also been included. GRA

N76-20354# Naval Postgraduate School, Monterey, Calif.
THE EXTENDED GAIN HYPOLE ANTENNA: AN APPLICATION OF COMPUTER MODELING TO ANTENNA DESIGN M.S. Thesis
Charles James Melchioris, Jr. and Salih Ahmet Turna Sep. 1975 78 p refs
(AD-A017533) Avail: NTIS CSCL 09/5

The Hypole is an experimentally developed hybrid dipole antenna for use in land mobile and shipboard communication systems. It employs a unique feed system to provide isolation from the degrading effects of a limited ground plane. This results in an increase in performance over an end-fed half-wave dipole similarly employed. Since the Hypole acts as a half-wave dipole isolated from ground, the possibility of improving its performance by the addition of a second properly phase half-wavelength element exists. A design approach using a thin wire antenna computer program was selected over the more tedious trial-and-error procedures on an experimental development. The validity of a computer model of the Hypole antenna was verified experimentally. This model served as the basis for designing the extended gain Hypole antenna, which when built provided a 2.7 db gain over the Hypole. This study demonstrates the successful application of the computer modeling approach to antenna design. Author (GRA)

N76-20355# Michigan Univ., Ann Arbor.
FIELD PENETRATION INTO A CYLINDRICAL CAVITY Final Report
T. B. A. Senior Sep. 1975 27 p refs
(Contract F29601-74-C-0010; AF Proj. 3673)
(AD-A017323; AFWL-TR-75-92) Avail: NTIS CSCL 20/3

To test the efficacy of a direct integral equation approach to the study of cavity-aperture interactions, the problem of an E-polarized plane electromagnetic wave incident on a thin, perfectly conducting cylindrical shell with a slit aperture is considered. A computer program is constructed for the solution of the appropriate E-field integral equation. Data are presented showing the behavior of the field inside the cavity and in the aperture for a variety of aperture and cavity dimensions, and some information is obtained about the SEM singularities and dependence on aperture size. GRA

N76-20356# Michigan Univ., Ann Arbor.
THE SPHERICAL CAVITY PROBLEM Final Report
T. B. A. Senior Sep. 1975 48 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)
(AD-A017324; AFWL-TR-75-72) Avail: NTIS CSCL 20/3

For a time-harmonic electromagnetic field incident on a thin, perfectly conducting spherical shell with a circular aperture, methods for the exact determination of the interior fields are discussed. The advantages of the direct E-field integral equation are pointed out. The unknowns are then the tangential components of the currents induced in the shell, and two alternative versions of the resulting coupled integral equations are developed. The one found most convenient is particularized to the case of a plane wave incident symmetrically upon the aperture. GRA

N76-20357# Rock Island Arsenal Lab., Ill. General Thomas J. Rodman Lab.
INVESTIGATION OF DIGITAL FILTERING TECHNIQUES FOR THE ANALYSIS OF EXPERIMENTAL DATA Final Report, Nov. 1974 - Jun. 1975
Lanny D. Wells Jun. 1975 45 p
(AD-A016928; RIA-R-TR-75-024) Avail: NTIS CSCL 09/4

This paper presents techniques of processing digital data to remove unwanted frequencies and to simulate the effect of simple RC networks on the corresponding analog data. The development of these techniques provides: a means of isolating a signal from background noise, a means of removing low frequency drift from a signal, and a means of selectively reversing previous filtering. These techniques are valuable in the refinement and validation of digital simulations. The method presented in this paper used the Fast Fourier Transform. The methodology has been applied to remove noise and drift from experimental and mathematical model date relative to determining an RMS value of a tank gun pointing error. GRA

N76-20358# Ohio State Univ., Columbus. ElectroScience Lab.
INVESTIGATION OF THE GRAIN MEASURED IN PERIODIC SLOTTED SURFACES Interim Technical Report
R. D. Fulton Wright-Patterson AFB, Ohio AFAL Mar. 1975 39 p refs
(Contract F33615-73-C-1173)
(AD-A016986; ESL-3622-5) Avail: NTIS CSCL 09/5

For some time now measurements of planar arrays of slots have shown gain (transmission coefficients greater than unity) at high angles of incidence. The report is a summary of an investigation to determine why gain has been measured since conservation of energy prohibits amplification by such an array. Two possible causes are considered: (1) Focusing by the array, and (2) diffraction from the aperture in the ground plane used for carrying out the measurements. Results of analytical investigations and measurements indicate that edge diffraction is the cause. This work is significant to the Air Force because it will allow greater accuracy in and understanding of measurements made on slotted surfaces such as used for metallic radomes. GRA

N76-20359# Ohio State Univ., Columbus. ElectroScience Lab.
SCATTERING PROPERTIES OF PERIODIC ARRAYS CONSISTING OF RESONANT MULTI-MODE ELEMENTS
Edward L. Pelton Wright-Patterson AFB, Ohio AFAL Sep. 1975 182 p refs
(Contract F33615-73-C-1173; AF Proj. 7633)
(AD-A016950; ESL-3622-3; AFAL-TR-75-98) Avail: NTIS CSCL 09/5

The report presents the results of an investigation of the reflection properties of periodic arrays of dipoles. Through Babinet's principle the results obtained also apply to periodic slot arrays. The specific periodic array geometries treated are composed of Y elements and symmetrical crossed elements. In the theoretical investigation presented for the Y element arrays, both the element geometry and array grid structure are treated as adjustable design parameters. By applying the results presented an unlimited number of useful Y element array geometries having different grid structures can be obtained. Three specific array geometries are presented to demonstrate the design principles involved and the array performance attainable. Obtaining useful array configurations requires simultaneous analytical design of both the element and grid geometries. A method is described for obtaining specific optimum Y array designs. GRA

N76-20360# Army Electronics Command, Fort Monmouth, N.J.
ROTOR BLADE EFFECTS ON L-BAND SIGNALS RECEIVED BY HELICOPTER ANTENNAS MOUNTED ABOVE THE ROTOR BLADE (CW) EXPERIMENTS Final Experimental Report for 1974
C. M. DeSantis and F. Schwering Oct. 1975 118 p
(DA Proj. 1T1-61102-B-31A)
(AD-A016866; ECOM-4357) Avail: NTIS CSCL 09/5

Rotor effects on L-Band signals received by helicopter antennas have been examined experimentally. CW data for two receiving-antenna locations above the rotor blade, viz. at the

turning axis of the blade and on the tail, is presented. This data shows the amplitude and phase variations to be expected as a function of the direction of the incident signal. The effects of counterpoise size and height above the main rotor are also studied. In general, it is shown that the signal variations were typically < plus or minus 3 db for polar angles of arrival theta < or equal to 70 deg; but that for greater angles, the signal amplitude changes by as much as plus or minus 7 db. For thata = 90 deg (an arrival angle obtained, for instance, during a turning and banking maneuver) signal levels can decrease by minus 15 db and the phase variation can exceed 180 deg. The tail location appears to be a better choice for the antenna than the center location. A worst-case analysis of CW, rotor effects is presented in Appendix I. Appendices II and III contain some of the data measured at both antenna locations and should be referred to for a better understanding of the signal variations involved.
Author (GRA)

N76-20361# Institute for Telecommunication Sciences, Boulder, Colo.
RADIATING AERIAL COAXIAL CABLE MEASUREMENTS
Tom Harr, Jr. and John Juroshek Oct. 1975 39 p refs Sponsored by FAA
(PB-246553/2; OTR-75-73) Avail: NTIS HC $4.00 CSCL 09E

In the measurements presented, an aerial coaxial cable system is considered to be an antenna. The cable system that was used was modified so that 'broken cable test sections' could be installed in the cable run. The test results show a large variation in antenna power gain of the five test sections tested, with two of the test sections having a power gain greater than isotropic in the main lobe region. The cable parameters, measurement techniques, and test results are contained. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-20362 Kansas State Univ., Manhattan.
SILICON-CONTROLLED RECTIFIER CHOPPERS FOR DIRECT-CURRENT VOLTAGE CONTROL Ph.D. Thesis
Mudhafar Anwar Alnema 1973 149 p
Avail: Univ. Microfilms Order No. 76-5874

The silicon controlled rectifier (SCR) chopper is a direct-current to direct-current converter. There are two basic types of choppers--fixed frequency variable pulse width, or fixed pulse width variable frequency. These two types can be combined to form a third type, i.e., variable pulse width variable frequency. The fixed frequency variable pulse width chopper was studied. The theoretical equations of chopper systems in drive and regeneration modes are analyzed. Also studied were two conventional chopper circuits that are most frequently used, the Jones chopper and the cathode-pulse turn-off chopper. A method was applied for the improved design of the commutating elements in conventional chopper circuits. A new chopper is proposed. Analysis and design of the new chopper are highlighted.
Dissert. Abstr.

N76-20363 Stanford Univ., Calif.
ADVANCED INTEGRATED CIRCUIT TECHNOLOGY FOR MICROPOWER INTEGRATED CIRCUITS Ph.D. Thesis
Thurman John Rodgers 1975 233 p
Avail: Univ. Microfilms Order No. 76-5790

A four mask v-groove process for the fabrication of bipolar integrated circuits is presented. The epitaxial v-groove (EVG) process utilizes epitaxial N(-)/N(+)/N(-) layers and anisotropic etching of <100> silicon to eliminate the buried layer and isolation diffusions as well as the need for masking the base diffusion of the standard buried collector (SBC) six mask bipolar integrated circuit process. The NPN transistor characteristics are equivalent to or exceed those of the standard process. A five mask v-groove process provides improved lateral P-N-P transistors compared with the four mask approach. The v-groove integrated circuit structure offers simpler processing, smaller isolation capacitance, lower parasitic collector resistances, and larger packing densities than the conventional SBC process. The reduced isolation capacitance of EVG transistors is the key to good micropower performance. The two steps in the EVG process which are not commonly used - deposition of non-uniformly doped-epitaxial layers and anisotropic etching - are discussed.
Dissert. Abstr.

N76-20364 Massachusetts Univ., Amherst.
AN EXPERIMENTAL STUDY OF ELECTRIC FIELDS DEVELOPED ON METAL SURFACES UNDER ACCELERATION Ph.D. Thesis
Guy G. Yagunoff 1975 153 p
Avail: Univ. Microfilms Order No. 76-5362

With relevance to the gravitational-induced electric fields near a conductor, a modulation technique was applied to the measurement of electric potentials along the surface of accelerating metals and a theory developed explicitly demonstrating the dependence of the induced electric fields on the chemical potential and surface dipole. Experimental results are presented for A, Mg, Cu, Ta and Ti samples under accelerations in the range of 0.05g to 0.5g. Suggestions are made for additional theoretical development and experiments to separate the surface dipole and chemical potential contributions. Dissert. Abstr.

N76-20365+ Compagnie Generale d'Electricite, Marcoussis (France). Section Composants Electroniques.
HIGH FREQUENCY NOISE AND SOURCE DETERMINATION USING THE THIN BASE TRANSISTOR MODEL Final Report [APPLICATION DU MODELE DE TRANSISTOR A BASE MINCE A L'ETUDE DU BRUIT A HAUTE FREQUENCE. ETUDE ET LOCALISATION DES SOURCES]
J. Y. Fourrier Sep. 1974 57 p refs In FRENCH
(Contract DGRST-73-7-1393)
Avail: NTIS HC $4.50

The localization and intensity of thermal and short noise were determined by an extension of the Van Der Ziel classical analysis. In spite of simplifying assumptions such as transistor linearity, absence of high injection phenomena and of the reaction capacitance and same value of the current amplification in various frequency ranges, the agreement between experiment and simulation is good in the frequency range from 1 MHz to 5 GHz and for current densities lower than 6,000 A/sq cm.
ESA

N76-20366 Radiotechniques S. A., Caen (France). Div. Industrielle et Technique.
PRELIMINARY STUDY ON AN OPTOELECTRONIC POWER RELAY Final Report [ETUDE PRELIMINAIRE. LE RELAIS DE PUISSANCE OPTOELECTRONIQUE]
M. Bartha, M. Bonis, and J. C. Dubois 25 Oct. 1974 10 p In FRENCH
(Contract DGRST-73-7-1381)
Avail: Issuing Activity

The feasibility of producing high voltage phototransistors and photodarlingtons for power relays was evaluated. The theory of a phototransistor was reviewed with regard to independent parameter influence. The mesa technology was applied to devices supporting 400V without sacrificing photosensitivity. Extensions to 600V are contemplated. Some photocouplers thus made were characterized and associated with a thyristor for performance testing within a loaded circuit operating under 5A and 220V.
ESA

N76-20367*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE PRACTICAL OPERATIONAL-AMPLIFIER GYRATOR CIRCUIT FOR INDUCTORLESS FILTER SYNTHESIS
W. C. Sutherland Mar. 1976 119 p refs
(NASA-TM-X-64995) Avail: NTIS HC $5.50 CSCL 09C

A literature is reported for gyrator circuits utilizing operational amplifiers as the active device. A gyrator is a two port nonreciprocal device with the property that the input impedance is proportional to the reciprocal of the load impedance. Following

an experimental study, the gyrator circuit with optimum properties was selected for additional testing. A theoretical analysis was performed and compared to the experimental results for excellent agreement. Author

N76-20368# Toulouse Univ. (France).
INVESTIGATIONS OF THE DROP IN DIRECT POTENTIAL IN P-I-N DIODES AND THYRISTORS Ph.D. Thesis [ETUDE DE LA CHUTE DE TENSION DIRECTE DANS LES DIODES P-I-N ET LES THYRISTORS]
Gilles Enea 27 Nov. 1975 180 p refs In FRENCH
Avail: NTIS HC $7.50

The steady-state polarization behavior of P-I-N diodes and thyristors was studied. The primary interest was focussed on the resulting current density and on optimization of the direct potential drop due to the effect of various parameters. This was applied to the practical problem of Joule losses, without however considering the complementary 'frequency-power' problem. The investigation is divided in four areas: (1) derivation of an operational program and numerical analysis, (2) study of P-I-N diodes, (3) study of thyristors at different levels of polarization, and (4) application to a system consisting of the above components. Transl. by Y.J.A.

N76-20369*# National Aeronautics and Space Administration, Washington, D.C.
SPACE ELECTRONICS TECHNOLOGY SUMMARY
Mar. 1976 245 p
(NASA-TM-X-73044) Avail: NTIS HC $8.00 CSCL 09C

An overview is given of current electronics R and D activities, potential future thrusts, and related NASA payoffs. Major increases in NASA mission return and significant concurrent reductions in mission cost appear possible through a focused, long range electronics technology program. The overview covers: guidance assessments, navigation and control, and sensing and data acquisition processing, storage, and transfer. Author

N76-20370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR INDUCTION MOTOR ANALYSIS
Gary Bollenbacher Washington Mar. 1976 86 p refs
(NASA-TN-D-8184; E-8486) Avail: NTIS HC $5.00 CSCL 09C

A FORTRAN program for induction motor analysis is described. The analysis includes calculations of torque-speed characteristics, efficiency, losses, magnetic flux densities, weights, and various electrical parameters. The program is limited to three-phase Y-connected, squirrel-cage motors. Detailed instructions for using the program are given. The analysis equations are documented, and the sources of the equations are referenced. The appendixes include a FORTRAN symbol list, a complete explanation of input requirements, and a list of error messages. Author

N76-20371# Battelle Columbus Labs., Ohio.
ENERGY USE PATTERNS IN METALLURGICAL AND NONMETALLIC MINERAL PROCESSING. PHASE 5: ENERGY DATA END FLOWSHEETS, INTERMEDIATE-PRIORITY COMMODITIES
16 Sep. 1975 242 p refs
(Contract S0144093)
(PB-246357/8; BM-OFR-96-75) Avail: NTIS HC $8.00 CSCL 08I

These commodities and their appropriate primary products were originally selected for this category either because of an expected fairly high total annual energy requirement to produce or because of the fairly large tonnage produced each year. All of these commodities are important basic industrial materials and, therefore, this detailed energy appraisal should be of particular value in assessing the national pattern of energy consumption. This study differs from the usual energy analysis because it includes estimated energy values for mining and benefication, consumable raw materials, transportation, and fuels and electrical energy. GRA

N76-20372*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRONIC CIRCUITS: A COMPILATION Technology Utilization
Jan. 1976 45 p
(NASA-SP-5972(07)) Avail: NTIS HC $1.00 CSCL 09C

A compilation containing articles on newly developed electronic circuits and systems is presented. It is divided into two sections: (1) section 1 on circuits and techniques of particular interest in communications technology, and (2) section 2 on circuits designed for a variety of specific applications. The latest patent information available is also given. Circuit diagrams are shown. Author

N76-20373# AEG-Telefunken, Frankfurt am Main (West Germany).
DEVELOPMENT OF METHOD FOR PRODUCING EPITAXIAL pn JUNCTIONS [ENTWICKLUNG VON VERFAHREN ZUR HERSTELLUNG VON EPITAKTISCHENpn-UEBERGAENGEN]
Kurt Roy Bonn Bundesmin. fuer Forsch. U. Technol. Oct. 1975 189 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u Technol.
(BMFT-FB-T-75-21) Avail: NTIS HC $7.50; ZLDI, Munich DM 39,70

The silicon chloride epitaxy can be used to produce pn-junctions with high blocking voltages over a large area. Their electrical breakdown is mainly influenced by the preparation of the substrate surface. Blocking voltages of more than 3500 volt over surfaces of 5 to 10 sqcm have been obtained by etching the substrate immediately before epitaxy with sulfur hexafluoride at temperatures above 1200 C. For blocking voltages up to 2000 volt, a yield of more than 80%. I was obtained lifetime measurements indicate that there should be no further problems using epitaxy in power electronics. Author (ESA)

N76-20374# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
AN L-BAND SHIP ANTENNA WITH VARIABLE CONICAL RADIATION PATTERN FOR MARITIME SATELLITE COMMUNICATION SYSTEMS
Hans Forster, Horst Mattes, and Arno Schrott 16 Oct. 1975 85 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-66) Avail: NTIS HC $5.00, DFVLR, Cologne DM 32,10

The basic concept, development and construction of an L-band ship's antenna (1535 MHz to 1645 MHz) with stabilized platform is described in detail. The antenna pattern of the medium gain antenna (minimum gain 7 db) is a conical beam. The radiation at all azimuth angles is omnidirectional. The elevation angle of the conical beam is infinitely variable. The polarization of the radiation is right-hand circular in the direction of the antenna axis and becomes more and more elliptical for decreasing elevation angles. Due to the simple antenna control system, the low weight, and the costs, this antenna system is particularly suitable for small ships. Author (ESA)

N76-20375# Plessey Co. Ltd., Towcester (England).
RELIABILITY AND FAILURE MODE ANALYSIS OF GaAs FET's AT X-BAND Final Report, Feb. - Jul. 1975
D. A. Abbott and J. A. Turner Jul. 1975 48 p refs
(Contract ESTEC-2308/74-AK)
(CD.6500610/K; ESA-CR(P)-778) Avail: NTIS HC $4.00

A series of tests were carried out on commercially available GaAs FET devices of the type GAT 2 and GAT 3. The tests overstressed the devices to accelerate failure so the failure modes could be observed within a short period of time. Tests carried out were: dc burn-in, dc bias, thermal cycling, ac burn-in, RF test, and thermal impedance measurements. Given certain selection criteria the FETs are found to be reliable devices. The main area of concern is the channel region when small irregularities in the metallization definition can accelerate failure. Areas where further investigation would be fruitful are: ohmic contacts and the gate itself with failures caused by spike breakdown. ESA

N76-20376# Centre National d'Etudes Spatiales, Toulouse (France).
BREAKDOWN PHENOMENA IN SEMICONDUCTOR DEVICES [LES PHENOMENES DE CLAQUAGE DANS LES

SEMI-CONDUCTEURS]
Daniel Hernandez Sep. 1975 36 p In FRENCH; ENGLISH summary
(CNES-NT-23) Avail: NTIS HC $4.00

The main basic physical phenomena observed and their macroscopic characteristics are summarized. Different kinds of transistor breakdowns are discussed together with their reversible or irreversible consequences. Reliability improvement is discussed as a result of consideration of the fluctuation of breakdown characteristics related to internal parameters. ESA

N76-20377# Centre National d'Etudes Spatiales, Toulouse (France).
THEORY AND PRACTICE OF SEMICONDUCTOR NOISE [THEORIE ET PRATIQUE DU BRUIT DANS LES SEMICONDUCTEURS]
Daniel Hernandez Sep. 1975 36 p In FRENCH; ENGLISH summary
(CNES-NT-24) Avail: NTIS HC $4.00

A survey is presented of the different sources of semiconductor noise and also of equivalent noise models, and methods are described for measuring noise parameters. Some typical results observed for two standard operational amplifiers LM108A and HA2700 are described, and the validity of the noise measurement methods employed is discussed. ESA

N76-20378# Research Triangle Inst., Research Triangle Park, N.C.
TRANSIENT SURFACE DAMAGE AND LATCHUP IN GMOS DEVICES Final Report, 13 May 1974 - 12 May 1975
M. Simons Jun. 1975 63 p refs
(Contract N00014-74-C-0433)
(AD-A014042; RTI-43U-991) Avail: NTIS CSCL 09/1

The work consists of concurrent studies of transient surface damage and latchup phenomena in irradiated CMOS devices. Isothermal V sub th annealing data are presented for CMOS 4007 inverters from 0.0001 to 0.001 sec after exposure to ionizing radiation pulses. Commercial and research samples prepared on bulk silicon as well as silicon-on-saphire substrates are evaluated. High and low temperature annealing data are used to develop extended room temperature annealing characteristics over the 0.000001 and 10 to the 8th power sec post exposure interval. Electrical measurements and radiation tests have been conducted on selected commercial CMOS devices in an assessment of their susceptibility to radiation-induced latchup. A latchup problem has been identified in four of the thirteen circuit types tested. Test results along with some techniques for avoiding latchup are discussed. GRA

N76-20379# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
EXPERIMENTAL STUDY OF THE SWITCHING CHARACTERISTICS OF BISTABLE AMPLIFIERS IN THE LAMINAR AND TURBULENT FLOW REGIMES Final Report, Feb. 1974 - Jan. 1975
Guy Bekaert and Mario Carbonaro Jul. 1975 111 p refs
(Contract DAJA37-74-C-2689; DA Proj. 200-61102-B-33E)
(AD-A014969) Avail: NTIS CSCL 13/7

The parametric study on the switching phenomenon in a large scale model of wall attachment bistable amplifier was continued. The model consisted of two straight walls of various lengths, set-backs and angles without vents and splitter. Previous turbulent air flow data for aspect ratios of 8 and 4 was extended to aspect ratios of 2 and 1. Switching times were measured as well as steady pressure distributions on both walls and in the outlet section. Switching times were obtained from oscilloscope recordings of the velocity (measured by a hot wire) and the pitot pressure in the control and output channels. The possibility of operating a bistable amplifier in the laminar flow regime was also experimentally investigated. GRA

N76-20380# Raytheon Co., Waltham, Mass. Research Div.
DISTRIBUTED FERRITE ISOLATION IN TRAVELING-WAVE TUBES Annual Status Report, Jun. 1974 - Jul. 1975
John Osepchuk and Daniel Masse 2 Sep. 1975 119 p refs
(Contract N00014-74-C-0322; NR Proj. 251-016; RF54545001)
(AD-A016285) Avail: NTIS CSCL 09/1

The report describes the status after one year of a program to introduce distributed ferrite isolation in a high power CW traveling-wave tube of broad bandwidth = 1 octave. Cold tests indicate feasibility of over 50 db reverse loss and only 5 db forward loss. The best results occur when there is coupling to broadband edge modes of ferrite slabs. Evidence of coupling to the lower branch of edge mode, i.e., magnetostatic, has been obtained with L-band helix. Cold tests and analysis suggest coupling to ferrite edge modes from helix is easier at higher microwave frequencies. Plans for a hot test at the 1-2 kW power level is an L-band TWT incorporating such distributed ferrites are described. GRA

N76-20381# Delta Electronic Control Corp., Costa Mesa, Calif.
DEVELOPMENT OF A LOW-COST, LIGHT-WEIGHT, EFFICIENT, 1.5 KW INVERTER Final Report
L. R. Suelzle and J. S. Suelzle Sep. 1975 48 p ref
(Contract DAAK02-74-C-0388)
(AD-A016792; DECC-61098-003) Avail: NTIS CSCL 10/2

The effective use of low-voltage dc power sources, such as fuel cells and batteries, requires efficient power conversion equipment to provide ac voltages. The development of a silent, light-weight inverter is discussed in this paper. The inverter is capable of delivering 1.5 KW into a 0.8-1.0 power factor load at 120 or 240 Vac and at 60 or 400 Hz. GRA

N76-20382# New York State Atomic and Space Development Authority, N.Y.
PTI-ASDA RESEARCH PROGRAM INTO COMPACT TRANSMISSION LINES AND HPOF CABLES. PART 1: OVERHEAD Final Report
31 Mar. 1974 150 p refs Prepared by Power Technologies, Inc.
(PB-245678/8; NYSERDA-75/03-Pt-1) Avail: NTIS HC $6.00 CSCL 09A

Tests and analyses conducted on an experimental compact 138 kv line with 36 inches phase-to-phase spacing have demonstrated the technical and economic feasibility of lower compact overhead transmission lines. These lines are capable of transmitting up to four times the power for a given right-of-way with minimum intrusion of the environment and can be constructed with conventional ancillary equipment and materials. The reliability of performance is projected as being equivalent to that experienced by conventional transmission line designs. GRA

N76-20383# New York State Atomic and Space Development Authority, N.Y.
PTI-ASDA RESEARCH PROGRAM INTO COMPACT TRANSMISSION LINES AND HPOF CABLES. PART 2: CABLES
31 Mar. 1975 123 p Prepared by Power Technologies, Inc.
(PB-245679/9; NYSERDA-75/04-Pt-2) Avail: NTIS HC $5.50 CSCL 09A

Tests and analyses have been conducted on an experimental 345 kV underground cable system operated in the forced cooled mode. Evaluation of the thermal and hydraulic characteristics of forced cooled High Pressure Oil-Filled systems indicate that under appropriate conditions, up to twice the normal capacity of selfcooled feeders is attainable. Information is presented to assist calbe engineers and utilities to design and operate underground cable systems with greater reliability and cost effectiveness GRA

N76-20384# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SUBMINIATURE METALLIZED POLYCARBONATE CAPACITORS Final Report, 8 Oct. 1968 - 10 Jun. 1975
Leonard Adelson Jun. 1975 248 p
(Contract DAAB05-69-C-0003; SEC Proj. A120-39)
(AD-A015529) Avail: NTIS CSCL 09/1

The objective of the work program for process improvement and testing of production lots of metallized polycarbonate film hermetically sealed capacitors was to establish a failure rate under static test conditions with a goal of .001% per 1,000 hours. In particular, effort was concentrated in the process improvement phase in these areas: (a) Quality of metallized polycarbonate film; (b) Heat Treatment of capacitor sections; (c) Shrinkage of film; (d) Solvent entrapment within the film; (e)

Burn-in of the completed capacitor. Information pertinent to the process factors evaluated and results obtained in each area is detailed and the engineering decisions incorporated into the pre-production and production lots are delineated. GRA

N76-20385# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF SUBMINIATURE METALLIZED POLYCARBONATE CAPACITORS Quarterly Report, 9 Oct. 1974 - 8 Jan. 1975
Leonard Adelson Feb. 1975 18 p
(Contract DAAB05-69-C-0003; SEC Proj. A120-39)
(AD-A015559; QR-25) Avail: NTIS CSCL 09/1

The object of this production engineering measure is to improve production techniques for the manufacture of subminiature metallized polycarbonate capacitors to attain a maximum failure rate of 0.001% per 1,000 hours with a 90% confidence level. GRA

N76-20386# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FLIGHT TEST EVALUATION OF A 240 TO 400 MHz CAVITY-BACKED CROSS OPEN-SLEEVE DIPOLE ANTENNA Test Report
Lowell R. Nawman and Howard E. King 10 Oct. 1975 34 p refs
(Contract F04701-75-C-0076)
(AD-A017298; TR-0076(6401)-1; SAMSO-TR-75-241) Avail: NTIS CSCL 09/5

The gain and radiation patterns of a cavity-backed open-sleeve cross dipole antenna mounted on a C135-type aircraft were measured via a satellite-to-aircraft link at 249.1 MHz. The antenna was designed for operation over the 240 to 400 MHz frequency band and has maximum dimensions of 21.5 in. square by 6 in. deep. For the purposes of the aircraft flight tests, the antenna was externally mounted to the fuselage and covered with a radome. The gain and radiation patterns of the antenna measured in the antenna range with the cavity mounted on a 9.5-ft by 9.5-ft cylindrically curved ground plane are also shown for comparison. GRA

N76-20387# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CHARACTERISTICS OF A 240 TO 400 MHz 6-INCH DEPTH CAVITY-BACKED CROSS OPEN-SLEEVE DIPOLE ANTENNA ON A CURVED GROUND PLANE Final Report, Dec. 1973 - May 1974
H. E. King, J. L. Wong, and C. E. Ermatinger 31 Oct. 1975 31 p refs
(Contract F04701-75-C-0076)
(AD-A017367; TR-0076(6401)-2; SAMSO-TR-75-224) Avail: NTIS CSCL 09/5

An open-sleeve cross dipole antenna contained within a 21.5 in. square x 6 in. deep cavity is described for operation in the 240 to 400 MHz band. The antenna was developed for an aircraft flight test evaluation using a satellite-to-air communication link. For the purposes of these flight tests on a KC-135 aircraft the antenna was externally mounted to the fuselage and covered with a radome. Measured VSWR, radiation patterns and gain with the antenna mounted on a 9.5 ft x 9.5 ft cylindrically curbed ground plane are shown. GRA

N76-20388# General Electric Co., Pittsfield, Mass.
DIGITAL MICROCIRCUIT CHARACTERIZATION AND SPECIFICATION, VOLUME 1 Final Technical Report, Feb. 1974 - Mar. 1975
Thomas M. Ostrowski Griffiss AFB, N. Y. RADC Aug. 1975 261 p 3 Vol.
(Contract F30602-74-C-0159; AF Proj. 5519)
(AD-A017313; RADC-TR-75-216-Vol-1) Avail: NTIS CSCL 09/5

The objective of the effort was to review proposed Mil-M-38510 digital integrated Circuit detail specifications for technical accuracy, completeness and conformance to establish military standards. This included worst case test situations, critical timing paths and generation of special screening procedures. Comprehensive laboratory investigations were conducted on low power Schottky devices and standard Schottky voltage breakdown modes to obtain data. The low power Schottky study included dc, switching and functional characteristics, vendor comparisons, specification guidelines and design rules. GRA

N76-20389# General Electric Co., Pittsfield, Mass.
DIGITAL MICROCIRCUIT CHARACTERIZATION AND SPECIFICATION, VOLUME 2 AND 3 Final Technical Report, Feb. 1974 - Mar. 1975
Thomas M. Ostrowski Griffiss AFB, N. Y. RADC Aug. 1975 254 p refs 3 Vol.
(Contract F30602-74-C-0159; AF Proj. 5519)
(AD-A017314; RADC-TR-75-216-Vol-2; RADC-TR-75-216-Vol-3) Avail: NTIS CSCL 09/5

The volume consists of logic integrity test (LIT) reports for tests generated for the integrated circuit devices listed in the index. All of the tests are for devices that either are already included in MIL-M-38510 slash sheets or are to be included in future slash sheets. LIT's were generated for TTL, STTL and CMOS family types. For the CMOS devices, additional tests were generated to check for worst case leakage paths. As a part of the test generations, the tests were proved by testing representative devices. In some instances LIT's were submitted by integrated circuit manufacturers whereupon they were checked for accuracy and completeness and then were edited, updated and proof tested. GRA

N76-20390# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 May - 31 Jul. 1975
Melvin A. Herlin and Alan L. McWhorter 24 Sep. 1975 20 p refs
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A016399; ESD-TR-75-246) Avail: NTIS CSCL 09/2

Topic areas covered are: Data systems digital computers, processor and education technology, computer systems, solid state device research, quantum electronics, materials research, microelectronics. GRA

N76-20391# Gudeman Corp., Chicago, Ill.
PRODUCTION ENGINEERING MEASURE FOR POLYSULFONE CAPACITORS FOR SHORT INTRUSION PROXIMITY FUZE Quarterly Report, 24 Feb. - 24 May 1975
Frank A. Lakowski 20 Jun. 1975 20 p refs
(Contract DAAB07-74-C-0337)
(AD-A016956; CSO-705-4; QR-4) Avail: NTIS CSCL 09/1

The object of the production engineering measure is to provide the production engineering necessary to improve the production process techniques of non-metal cased polysulfone capacitors used for short intrusion proximity fuzes. Capacitors are to be capable of meeting the requirements of SCS442 and MIL-C-55514 and are to attain a failure rate of 1% per 1000 hours at 90% confidence level at rated voltage at 85C. A quantity of 205 capacitors each of the .56, .1 and 2 UF First Test Articles were manufactured for official qualification and Gun Shock Test. One hundred twenty two (122) capacitors each of the above values satisfactorily completed the Official Qualification tests of Group I of Table X of MIL-C-55514A. GRA

N76-20392# Army Electronics Command, Fort Monmouth, N.J.
DESIGN OF A TUNABLE MAGNETIC CIRCUIT FOR K AND Ka BAND MICROWAVE FILTERS
Herbert A. Leupold, Frederick Rothwarf, and Doyle Edmiston Nov. 1975 34 p refs
(DA Proj. 1T1-61102-B-31A)
(AD-A017564; ECOM-4369) Avail: NTIS CSCL 09/5

A tunable permanent magnet structure was designed for use in microwave filters for the K and Ka bands. To avoid the excessive bulk and power consumption of the prototype electromagnet structures previously available, two high energy (1 inch x 3/8 inch) samarium-cobalt-5 permanent magnets were used as field sources and made tunable via electrical solenoids in the flux circuit. Magnetic circuit design calculations predicted that the necessary ambient fields (7.8 and 11.8 kilo-oersteds for the K and Ka bands respectively) were easily attainable in gaps of sufficient size to accommodate the necessary waveguides. Experimental values of field obtained in the gap of a prototype model agreed with the calculated values to within about 3%. The magnets also proved to be tunable over the ranges of both

bands. Comparison of the permanent magnet design with existing electromagnet structures shows substantial advantages of the former with regard to weight, bulk and power expenditure. GRA

N76-20393# Fairchild Camera and Instrument Corp., Mountain View, Calif. Fairchild Semiconductor Div.
ION IMPLANTED R2 JFET'S FOR OPERATIONAL AMPLIFIER'S Final Report, Apr. 1973 - Sep. 1974
John S. MacDougall, Kenneth R. Stafford, and Aubrey J. Keet L. G. Hanscom Field, Mass. AFCRL Mar. 1975 62 p refs
(Contract F19628-73-C-0154; AF Proj. 5710)
(AD-A017515; AFCRL-TR-75-0154) Avail: NTIS CSCL 09/5

The previous design work performed to develop a very resistant, radiation-hardened operational amplifier is summarized and analyzed. It was concluded that the use of ion implanted JFET's together with some circuit and layout modifications to the amplifier would result in a greatly improved circuit. GRA

N76-20394# Florida Univ., Gainesville. Dept. of Electrical Engineering.
INVESTIGATION AND STUDY OF COMPUTATIONAL TECHNIQUES FOR DESIGN AND FABRICATION OF INTEGRATED ELECTRONIC CIRCUITS Final Report, 7 Mar. 1974 - 30 Jun. 1975
David P. Kennedy Sep. 1975 309 p refs
(Grant MDA903-74-G5; ARPA Order 2700)
(AD-A017094) Avail: NTIS CSCL 09/5

Under ARPA Grant MDA903-74-G5, the University of Florida, Gainesville, Florida, has undertaken a program of study on the topic of Computer Engineering of Integrated Circuits. The purpose of this program was to identify problem areas associated with the design and development of integrated semiconductor circuits; problem areas that result in excessive cost and inadequate availability of the particular type electronic structures required by the DoD. An additional purpose of this study is to recommend a program of research and development directed toward alleviating the identified problem areas. GRA

N76-20395# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
TECHNOLOGY AND PHYSICS OF INFRARED AND POINT CONTACT DIODES Semiannual Technical Report
Ali Javan 9 Sep. 1975 15 p refs
(Contract F19628-74-C-0182; ARPA Order 2618; AF Proj. 2001)
(AD-A017205; AFCRL-TR-75-0496; SATR-2) Avail: NTIS CSCL 09/5

Background work for this contract performed by this laboratory has shown that the tunneling characteristics of junctions formed by a very thin dielectric layer surrounded by two metals is independent of frequency (from dc through 10 micrometer wavelength.) These junctions may be formed by a point contact on a lightly oxidized metal surface. Principal work done this period was construction of a mathematical model for an infrared antenna/diode combination and calculation of the expected operating parameters. A closed form analytical approximation was made and experimental checks on the model validity were started. An article based on this work will be prepared. GRA

N76-20396# Research Triangle Inst., Research Triangle Park, N.C.
AUTOMATION FEASIBILITY STUDY FOR MICROELECTRONIC WAFER AND INTEGRATED CIRCUIT TEST SET, TTU-311/E Final Report
G. S. Hayne and R. L. Beadles Oct. 1975 93 p refs
(Contract F29601-72-C-0090; AF Proj. 8809)
(AD-A017322; AFWL-TR-72-200) Avail: NTIS CSCL 09/5

The report describes an investigation of the feasibility of automating the microelectronic wafer and integrated circuit (IC) test set which was designed as an operator aid for the internal visual inspection of ICs. The theoretical limits to IC defect enhancement by single-element intensity spatial filtering as implemented in the test set are explored; an alternative filtering technique (array filtering) with potentially higher signal (defect) to noise (IC) ratio is also treated. The engineering tradeoffs made in the design of the test set are found to substantially affect automation feasibility, and additional test set limitations are discussed. It is concluded that, while automation of the test set is straightforward (one subsystem for automation is described in detail), the inherent limitations of single-element array filtering and the further specific details of the present test set cause immediate automation of the test set to be of doubtful value. A program is recommended to further evaluate the array filtering technique. GRA

N76-20397# TRW, Inc., Lawndale, Calif. Semiconductor Div.
PRODUCTION ENGINEERING MEASURE FOR AN INTEGRATED CIRCUIT POWER AMPLIFIER 600-1000 MHz FOR TACTICAL RADIO EQUIPMENT Quarterly Report, 1 Apr. - 30 Jun. 1975
Roger C. DeBloois Jun. 1975 53 p refs
(Contract DAAB05-72-C-5844)
(AD-A016949; QR-13) Avail: NTIS CSCL 09/5

The objective of the production engineering measure is to establish a production capability to manufacture broadband, highly reliable, integrated circuit amplifiers for use in Army Communications equipment. The work involves transistor design optimization, fabrication of an impedance transformer, and fabrication of a suitable substrate interconnection pattern and package. The program includes actual fabrication of test samples, a production run, and performance of electrical, mechanical, and environmental tests as required. Twelve of the first article amplifiers were environmentally tested during this quarter. The amplifiers were divided into groups of two and three and subjected to the various tests. Results are presented. GRA

N76-20398# Martin Marietta Aerospace, Orlando, Fla.
PWB PRODUCTION ASSEMBLY COST GUIDELINES Quarterly Progress Report, 26 Mar. - 31 Jul. 1975
Sol C. Osborne and Wendell R. Hutchinson Jul. 1975 121 p refs
(Contract DAAB07-75-C-0029)
(AD-A016962; OR-13826; QPR-1) Avail: NTIS CSCL 09/5

A mini-printed wiring board (PWB) production cost manual was prepared identifying and describing representative sections of a manual for the program goal of providing guidelines enabling user to select and evaluate manual and automatic assembly methods. Assembly and cost data was obtained by surveys defining PWBs and assembly capabilities including cost analysis models. GRA

N76-20399# Brooks and Perkins, Inc., Livonia, Mich.
DEVELOPMENT OF A LIGHTWEIGHT TACTICAL 50 TO 70 FOOT EXPANDABLE AB-864( )/G MAST Final Report, 30 Mar. 1971 - 9 Apr. 1974
Alfred J. Finster Nov. 1974 141 p
(Contract DAAB07-71-C-0169; DA Proj. 1S7-64701-D-536-12)
(AD-A009586; ECOM-0169-F-71; Rept-515) Avail: NTIS CSCL 09/5

The mast design developed is described. Engineering development models are discussed along with tests, results, and stress analyses. Main objectives of the program include: weight reduction, design a kit to extend the mast to 70 feet, design a safe and reliable system, and reduction of volume production costs. GRA

N76-20400# General Electric Co., Syracuse, N.Y. Electronics Lab.
THERMAL RESISTANCE OF MICROELECTRONIC PACKAGES. PART 1: RECOMMENDED METHOD 1012 (THERMAL CHARACTERISTICS) FOR MIL-STD-883. PART 2: SUMMARY OF ANALYSES AND EXPERIMENTAL DATA FOR THERMAL TEST PACKAGES AND MIL-M-38510 PACKAGES Final Report, 15 Feb. 1974 - 14 Mar. 1975
Gene K. Baxter and J. Walter Brouillette Griffiss AFB, N. Y. RADC Aug. 1975 106 p refs
(Contract F30602-74-C-0150; AF Proj. 5519)
(AD-A017444; RADC-TR-75-204-Pt-1/2) Avail: NTIS CSCL 09/5

Methods for measurement of thermal resistance and response curves, including MIL-STD-883 Method 1012, were evaluated to determine an optimum method to measure MIL-M-38510 packages. Computer simulation, IR and electrical measurements were evaluated and compared for special thermal test packages. A ratio of about 5:1 was shown to exist for the junction peak,

average and region temperature rise. Measurements can be misleading without proper interpretation. The optimum method, IR measurement of a coated chip, can measure only the junction region thermal resistance. GRA

N76-20401# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
HELIUM RESEARCH IN SUPPORT OF SUPERCONDUCTING POWER TRANSMISSION Annual Report, Sep. 1974 - Jul. 1975
V. D. Arp, D. E. Daney, M. C. Frederick, M. C. Jones, and P. R. Ludtke Oct. 1975 80 p refs
(Contract E(49-18)-2128)
(PB-246658/9; NBSIR-75-283; AR-1) Avail: NTIS HC $5.00 CSCL 09C

A report is made on a program of helium related research in support of superconducting power transmission. Program areas reported on are concerned with the dynamics of helium cooling systems--theoretical aspects of oscillatory behavior and experiments--and helium related measurements. The latter include pressure measurements, temperature measurement and the problem of impurity levels in the helium refrigerant. GRA

N76-20402# West Virginia Univ., Morgantown. Engineering Experiment Station.
STATISTICAL EVALUATION AND MITIGATION OF INDUCTIVE INTERFERENCE PROBLEMS IN PORTABLE POWER CABLES Final Report, 1972 - 1975
1 Aug. 1975 178 p refs
(Grant G0122088)
(PB-246386/7; BuMines-OFR-92-75) Avail: NTIS HC $7.50 CSCL 08I

Research on 3 years' effort by West Virginia University in the general area of mine electrical power systems is summarized. The first year's work, 1972 to 73, was largely concerned with the analysis of the intermachine arcing problem. The second year's work, 1973 to 74, was largely concerned with ground motives and system grounding. A very small effort was made to determine if certain items of protective equipment used in electric utilities could also be used in mine power systems. In 1974 to 75, a modular ground wire monitor was designed and built. This monitor is capable of being made more or less sophisticated as needed for particular applications. A module based on a phase-locked-loop was conceived and designed. A program on the reliability of mine electrical power system components was begun. GRA

N76-20403# Missouri Univ., Columbia. Dept. of Electrical Engineering.
LONG TERM SYSTEM DYNAMICS HYBRID SIMULATION Final Report
Granville E. Ott, Lewis N. Walker, Daniel T. Y. Wong, and Cyrus O. Harbourt May 1975 190 p refs Sponsored by Elec. Power Res. Inst.
(PB-245844/6; EPRI-908-1) Avail: NTIS HC $7.50 CSCL 10B

The long term dynamics of power systems using hybrid simulation was studied. A hybrid simulator was designed, constructed, and tested. A description of the hybrid simulator, operating instructions, and results of the studies performed are presented. This project has successfully demonstrated a working model of a faster-than-real-time hybrid simulator. The basic feasibility of the hybrid approach to perform long term dynamic studies was shown. Furthermore it was shown that the hybrid approach is feasible and practical for a wide range of additional studies and purposes. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-20404 Illinois Univ., Urbana.
GRAVITATIONAL INSTABILITIES IN A ROTATING FLUID Ph.D. Thesis
Daniel Kwok-Lun Tang 1975 222 p
Avail: Univ. Microfilms Order No. 76-6984

An experimental study of thermal convection and gravitational instabilities of a rotating fluid is presented. The fluid was contained in a right cylinder which is rotating about its vertical axis, and subjected to vertical temperature gradient. Two silicone oils having kinematic viscosities of 0.65 and 350 centistokes were used as test fluids. Two 11 inch diameter cylinders of heights 0.970 and 1.999 cm were employed. The heat transfer data were measured over a wide range of rotational speeds varied from 0 to 856 rpm. Dissert. Abstr.

N76-20405 California Inst. of Tech., Pasadena.
A CHEMICAL REACTION IN A TURBULENT JET Ph.D. Thesis
John Richard Shea, III 1976 137 p
Avail: Univ. Microfilms Order No. 76-6540

The rate of a chemical reaction in an axisymmetric turbulent jet is studied, and the results are used to determine the rate of molecular mixing in the jet. A turbulent jet containing dilute ozone in an inert mixture of nitrogen and oxygen flows into a stagnant tank of nitric oxide and nitrogen. When the gases mix on a molecular scale, the ozone and nitric oxide rapidly react to produce oxygen and nitrogen dioxide. The rate at which the mixing and chemical reaction proceeds is determined by using an ultraviolet light absorption technique to measure the time averaged ozone concentration at points throughout the jets mixing zone. A criterion is established for determining when a reaction of known chemical kinetics is sufficiently rapid that chemical nonequilibrium has a negligible effect on the mean reactant profile. When a reacting jet satisfies this criterion for equilibrium chemistry, the reactant profiles are found to be independent of jet Reynolds numbers from 4,000 to 32,000 based on the nozzle diameter. Dissert. Abstr.

N76-20406*+ New Mexico Univ., Albuquerque. Technology Application Center.
HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, 30 Sep. 1975
30 Sep. 1975 55 p Sponsored by NASA
(NASA-CR-146780) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC available by subscription only $48.00 CSCL 20M

Heat Pipe Technology is a continuing bibliographic summary of research on the subject of the heat pipe. This update to Heat Pipe Technology cites references identified during July, August, and September of 1975. A library containing essentially all of the articles and publications referenced in this update, and all the previous volumes has been established. Author

N76-20407*+ New Mexico Univ., Albuquerque. Technology Application Center.
HEAT PIPE TECHNOLOGY: A BIBLIOGRAPHY WITH ABSTRACTS Quarterly Update, 1 Jan. - 31 Mar. 1975
31 Mar. 1975 62 p Sponsored by NASA
(NASA-CR-145826) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC available by subscription only $48.00 CSCL 20M

Heat Pipe Technology is a continuing bibliographic summary of research on the subject of the heat pipe. This update to Heat Pipe Technology cites references identified during January, February, and March of 1975. A library containing essentially all of the articles and publications referenced in this update, and all the previous volumes, has been established. Author

N76-20408*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
SIMULATION OF TURBULENT WALL PRESSURE Progress Report
Robert L. Ash Mar. 1976 32 p refs
(Grant NsG-1100)
(NASA-CR-146534; TR-76-T2) Avail: NTIS HC $4.00 CSCL 20D

A computer program has been developed to simulate the transient wall pressure field produced by a low speed fully turbulent boundary layer. The theoretical basis for the simulation has been discussed and preliminary results from a pressure simulation are presented. Author

N76-20409# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMICS OF THE CAVITATION ZONE FOR AN UNDERWATER EXPLOSION NEAR A FREE SURFACE
V. K. Kedrinskii 1975 11 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 5, 1975 p 68-78
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The problem of the development of a cavitation zone and a rarefaction wave profile in the region of regular reflection of a spherical shock of an underwater explosion from a free surface is considered for an axisymmetric formulation within the framework of the model of a two-phase medium, which is a fluid in which cavitation free gas seeds are distributed uniformly. An example is given of the computation of the rarefaction wave profile and the visible cavitation zone at different times for the case of the explosion of a one-gram charge at 3 and 5.3 cm depths for initial 10 to the minus 11th power volume gas concentration and 0.00005 cm cavitation seed radius. Results of the computation are compared with experiment. Author

N76-20410*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DETERMINATION OF SURFACE HEAT FLUX USING A SINGLE EMBEDDED THERMOCOUPLE
S. D. Williams (Lockheed Electron. Co., Inc., Houston, Tex.) and D. M. Curry Feb. 1976 35 p refs
(NASA-TM-X-58176; JSC-10714) Avail: NTIS HC $4.00 CSCL 20M

An implicit numerical procedure was developed for predicting the transient heat flux to a material using a single embedded thermocouple. The accuracy of the method was demonstrated by comparisons with analytically generated test data. Author

N76-20411*# Computer Sciences Corp., Hampton, Va.
AN ALGORITHM FOR SELECTING A RADIATION TRANSPORT SUBGRID FOR ABLATION AND RADIATION COUPLED HYPERSONIC VISCOUS SHOCK-LAYER PROBLEMS
Charles W. Bolz, Jr. Mar. 1976 20 p refs
(Contract NAS1-12527)
(NASA-CR-144957) Avail: NTIS HC $3.50 CSCL 20D

An algorithm is described for selecting a grid subset for calculating radiative transport. The subset spacing is determined by using the variation in aerothermal properties across the full grid of the shock layer. Results show that a radiation grid subset of 15 to 20 points can be used for viscous-shock layer calculations where approximately 50 grid points are required to define the aerothermal profiles. Results are presented for various planetary entry conditions with and without mass injection to demonstrate both the validity and utility of the algorithm. Author

N76-20412*# Old Dominion Univ., Norfolk, Va. School of Engineering.
HIGH SUBSONIC FLOW TESTS OF A PARALLEL PIPE FOLLOWED BY A LARGE AREA RATIO DIFFUSER Final Technical Report
P. Stephen Barna Sep. 1975 33 p refs
(Contract NAS1-11707)
(NASA-CR-144955; TR-75-T13) Avail: NTIS HC $4.00 CSCL 20D

Experiments were performed on a pilot model duct system in order to explore its aerodynamic characteristics. The model was scaled from a design projected for the high speed operation mode of the Aircraft Noise Reduction Laboratory. The test results show that the model performed satisfactorily and therefore the projected design will most likely meet the specifications. Author

N76-20413*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
THE INTERACTION BETWEEN A SOLID BODY AND VISCOUS FLUID BY MARKER-AND-CELL METHOD
Robert Y. K. Cheng Feb. 1976 78 p refs
(Grant NGL-47-003-012)
(NASA-CR-146586; TR-76-CI) Avail: NTIS HC $5.00 CSCL 20D

A computational method for solving nonlinear problems relating to impact and penetration of a rigid body into a fluid type medium is presented. The numerical techniques, based on the Marker-and-Cell method, gives the pressure and velocity of the flow field. An important feature in this method is that the force and displacement of the rigid body interacting with the fluid during the impact and sinking phases are evaluated from the boundary stresses imposed by the fluid on the rigid body. A sample problem of low velocity penetration of a rigid block into still water is solved by this method. The computed time histories of the acceleration, pressure, and displacement of the block show food agreement with experimental measurements. A sample problem of high velocity impact of a rigid block into soft clay is also presented. Author

N76-20414*# Kanner (Leo) Associates, Redwood City, Calif.
STUDY OF THE INITIAL PHASES OF THE TRANSITION OF A PULSED BOUNDARY LAYER ON A FLAT PLATE
P. Duhamel (Natl. Coll. of Elec. and Mech.) Washington NASA Mar. 1976 39 p refs Transl. into ENGLISH from J. de Mecan. (France), v. 13, no. 4, Dec. 1974 p 569-599
(Contract NASw-2790)
(NASA-TT-F-16974) Avail: NTIS HC $4.00 CSCL 20D

Following a brief analysis of some recent articles on transition from laminar to turbulent flow on a flat plate and a survey of the associated stability theory, the onset of turbulence is studied theoretically by considering the evolutions of a disturbance superposed on a basic periodic flow. The numerical solution of this nonstationary problem shows that the carrier flow checks the periodic appearance of an unstable zone and that large wave numbers are enhanced far from the wall in the pulsating boundary layer. This time filtering is shown to be observed experimentally; it gives the spectral analysis (carried out by fast processing on a computer) some characteristic properties which are used to identify the effect of disturbances on the shape of the spectra. The emergence of two kinds of instabilities (with two different spectral densities) together with the above theoretical results leads to a visualization of the bursting process of turbulent spots as consisting of two stages. Author

N76-20415*# Kanner (Leo) Associates, Redwood City, Calif.
LASER VELOCIMETRY IN TURBULENT FLOW
X. Bouis, J. Haertig, J. P. Hancy, and G. Koerber Washington NASA Apr. 1976 55 p refs Transl. into ENGLISH of "Velocimetrie Laser dans des Ecoulements Turbulents" St. Louis, France, 30 Jan. 1975 52 p
(Contract NASw-2790)
(NASA-TT-F-16983) Avail: NTIS HC $4.50 CSCL 20D

A laser anemometer for turbulent flow analysis is described. Particles pass through two superimposed interference fringes of different orientation produced by an argon laser and detected by photomultiplier tubes with interferential filters; two instantaneous velocity components are obtained independently of other mechanical and thermomechanical parameters. In turbulent zones where velocity may invert itself, a Bragg cell can be introduced. Application to computation of the autocorrelation function and spectral power density of the velocity fluctuations is outlined. Special care was taken to ensure that particles actually followed the flow, that the measurement was sufficiently small, and that sampling bias was eliminated. Author

N76-20416*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A NUMERICAL SCHEME TO SOLVE UNSTABLE BOUNDARY VALUE PROBLEMS
Eugenia Kalnay-Rivas [1975] 26 p refs
(Grants NGR-22-009-727; NSF OCD-71-00333)
(NASA-CR-146552) Avail: NTIS HC $4.00 CSCL 20D

A new iterative scheme for solving boundary value problems is presented. It consists of the introduction of an artificial time dependence into a modified version of the system of equations. Then explicit forward integrations in time are followed by explicit integrations backwards in time. The method converges under much more general conditions than schemes based in forward

time integrations (false transient schemes). In particular it can attain a steady state solution of an elliptical system of equations even if the solution is unstable, in which case other iterative schemes fail to converge. The simplicity of its use makes it attractive for solving large systems of nonlinear equations.
Author

N76-20417# Science Applications, Inc., McLean, Va.
A NUMERICAL STUDY OF FREE-SURFACE WAVES
Martin Fritts Mar. 1976 20 p refs Sponsored by Navy
(SAI-76-528-WA) Avail: NTIS HC $3.50

The problem of free surface waves in a finite depth liquid was used to test the inviscid incompressible hydrocode, SPLISH. Initial results are given on the stability, convergence, and accuracy of the code.
Author

N76-20418# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF CAVITATION ON ACOUSTIC WAVE INTERACTION WITH A DEFORMABLE SURFACE
G. S. Pisarenko, Sh. U. Galiev, and A. A. Pavlov 1975 6 p refs Transl. into ENGLISH from Dopov. AN USSR, Ser. A, Fiz.-Mat. i Tekhn. N. (USSR), no. 11, 1975 p 1007-1010
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An approximate method is proposed to take account of the influence of cavitation in a fluid in the initial stage of wave interaction with an elastic body. The acceptability of the assumptions used in verified by comparing the results obtained with results of experiments.
Author

N76-20419*# Transemantics, Inc., Washington, D.C.
STABILITY OF A BOUNDARY LAYER OF AN INCOMPRESSIBLE FLUID OVER A SLOTTED SURFACE
S. A. Gaponov Washington NASA Feb. 1976 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Sibirsk Otd., Ser. Tekhn. Nauk (USSR), no. 8, issue 2, 1975 p 37-42
(Contract NASw-2792)
(NASA-TT-F-16896) Avail: NTIS HC $3.50 CSCL 20D

Boundary layer stability of a slotted surface is analyzed for the case when the boundary conditions for perturbations of the flow parameters depend on the longitudinal coordinate. The effect of the degree of nonuniformity of the penetrability of the slotted surface is studied. Results are compared with those obtained previously for a surface with uniform penetrability
Author

N76-20420*# Transemantics, Inc., Washington, D.C.
SOLUTION OF A NONLINEAR INVERSE PROBLEM FOR A GENERALIZED HEAT CONDUCTION EQUATION IN A REGION WITH MOBILE BOUNDARIES
O. M. Alifanov, Ye. A. Artyukhin, and B. M. Pankraton NASA Feb. 1976 15 p refs Transl. into ENGLISH from Inzh-Fiz Zh. (USSR), v. 29, no. 1, Jul. 1975 p 151-158
(Contract NASw-2792)
(NASA-TT-F-16890) Avail: NTIS HC $3.50 CSCL 20D

The numerical solution to a nonlinear inverse heat conduction problem in an area with mobile boundaries is examined. An algorithm for smoothing the experimental data in forming input data for the inverse problem is constructed on the basis of the regularization method.
Author

N76-20421*# Sigma Research, Inc., Richland, Wash.
HEAT PIPE TEMPERATURE CONTROL UTILIZING A SOLUBLE GAS ABSORPTION RESERVIOR
E. W. Saaski Feb. 1976 57 p refs Sponsored by NASA
(NASA-CR-137792) Avail: NTIS HC $4.50 CSCL 20D

A new gas-controlled heat pipe design is described which uses a liquid matrix reservior, or sponge, to replace the standard gas reservior. Reservior volume may be reduced by a factor of five to ten for certain gas-liquid combinations, while retaining the same level of temperature control. Experiments with ammonia, butane, and carbon dioxide control gases with methanol working fluid are discussed.
Author

N76-20422# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
HEAT TRANSFER AND ABLATION
DFVLR 29 Oct. 1975 97 p refs In GERMAN; ENGLISH summaries Proc. of the DGLR Hydro- Aero- and Gasdyn. Comm. Meeting, Cologne, 15 May 1975
(DLR-Mitt-75-20) Avail: NTIS HC $5.00; DFVLR, Cologne DM 34.30

Topics in heat and mass transfer related to reentry shielding are covered. An analytical model was developed for the transient one-dimensional ablation of a Teflon ablation layer. Two approximation methods are proposed for calculating the gaseous diffusion in multicomponent mixtures. The heat transfer near stagnation point of blunt bodies in hypersonic low density gas flow was investigated. Two methods for determining unsteady heating of a slag forming plastic material are discussed. Ablation characteristics of carbon fiber carbon materials were determined. Experimental results of ablation behavior of Teflon models, and of stagnation point heat transfer on a blunt cone, are presented. For individual titles, see N76-20423 through N76-20429.

N76-20423 Stuttgart Univ. (West Germany). Inst. fuer Technische Thermodynamik und Thermische Verfahrenstechnik.
HEAT AND MASS TRANSFER WITHIN TEFLON LAYERS IN ABLATION COOLING **c27**
Karl Stephan and Bernhard Holzknecht (Bochum Univ., West Ger.) *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 7-16 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

An analytical model was developed for the transient, one-dimensional ablation of a Teflon ablation layer. It takes into account the crystalline-amorphous phase transition, the thermal expansion, the depolymerization, and the formation of higher-molecular products at the surface. The results of the numerical computation are compared with ablation measurements in arc jet facilities for transient ablation and the limiting case of quasisteady ablation. The course of the ablation process in principle is illustrated. Different influences and limiting cases were investigated.
Author (ESA)

N76-20424 Gesamthochschule, Siegen (West Germany).
CALCULATION OF THE DIFFUSION IN MULTICOMPONENT MIXTURES [ZUR BERECHNUNG DER DIFFUSION IN VIELKOMPONENTENGEMISCHEN]
A. Schaber and E. Obermeier *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 17-22 refs In GERMAN (For availability see N76-20422 11-34)

Two approximation methods for calculating the gaseous diffusion are proposed. The first method is based on the mean free path theory of the elementary kinetic gas theory, which produces an approximation formula for the polynary diffusion coefficients Dik. The second approximation results from a simplification of the Stefan-Maxwell equations using a materials group model.
ESA

N76-20425 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).
HEAT TRANSFER ON SPACE FLIGHT BODIES FOR VIBRATION RELAXATION [WAERMEUEBERGANG AUF RAUMFLUGKOERPER BEI SCHWINGUNGSRELAXATION]
B. Schmitt-vonSchubert *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 23-35 refs In GERMAN (For availability see N76-20422 11-34)
(Contract Wu-50/20)

The heat transfer near stagnation point of blunt bodies in hypersonic low density gas flow was investigated. The dissipation effects of vibration relaxation, as well as that of friction and thermal conduction, were considered. Heat transfer was calculated under space environment conditions and under wind tunnel simulation conditions. Theoretical results agree well with experimental results obtained by various authors.
ESA

N76-20426 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Abteilung R01.
METHODS FOR PREDICTING ABLATION BEHAVIOR. A SURVEY OF WORK AT MBB [VERFAHREN ZUR VORAUSSAGE DES ABLATIONSVERHALTENS - EIN UEBERBLICK UEBER DIE ARBEITEN BEI MBB]
P. Mittelbach *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 39-50 refs In GERMAN (For availability see N76-20422 11-34)

Two methods for determining unsteady heating of slag forming

plastic materials are discussed. The first is based on an empirical decomposition relation for calculation of the exact density profile and a pyrolysis gas rate (finite pyrolysis zone). The second is based on an infinitely thin layer pyrolysis zone. In this case the pyrolysis gas rate is determined by an energetic intermediate condition for a pyrolysis temperature. An implicit difference method is used for numerical solution in both cases. ESA

N76-20427 Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Abteilung R01.

ABLATION CHARACTERISTICS OF CFC MATERIALS c24

H. Grallert *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 51-65 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

The principal possibilities for the optimization of Carbon Fiber Carbon (CFC) ablation characteristics and all plasma channel tests with these thermal protection materials are summarized. Some examples for ablation theoretical verification of test results are presented. Author (ESA)

N76-20428 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

ABLATION BEHAVIOR OF TEFLON MODELS c27

K. Kindler *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 67-82 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

Experimental results of ablation behavior of Teflon models are presented. The influence of the body shape (blunt cone, hemisphere, flat) on the mass loss rate and the development of the internal temperature is discussed. The information content of the results is evaluated. A comparison is made with previous data. Author (ESA)

N76-20429 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Angewandte Gasdynamik.

EFFECT OF BODY GEOMETRY ON HEAT TRANSFER IN STAGNATION POINT

F. Bachour *In* DGLR Heat Transfer and Ablation 29 Oct. 1975 p 83-96 refs In GERMAN; ENGLISH summary (For availability see N76-20422 11-34)

Experimental results of stagnation point heat transfer on a blunt cone are reported. Heat transfer does not behave according to continuum theory in the regime of highly rarefied gases. The model length becomes the dominating parameter. Author (ESA)

N76-20430# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Raumsimulation.

HEAT TRANSFER AND PRESSURE DROP OF EVAPORATING NITROGEN FLOWING IN A HORIZONTAL TUBE Ph.D. Thesis - Tech. Hochschule Aachen

Guenter Klein 21 Oct. 1975 151 p refs In GERMAN; ENGLISH summary

(DLR-FB-75-68) Avail: NTIS HC $6.75; DFVLR, Cologne DM 62,80

The local heat transfer and the pressure drop were experimentally investigated in the convective and in the nucleate boiling region as a function of heat flux, quality, and mass flow density. The test section was made from a drawn copper tube of 12 mm inner diameter. All the measurements were carried out at a boiling pressure of 3,0 bar. The resulting flow pattern of the two phase flow could be observed and photographed in an unheated sight tube convected to the heated section. The experimental values for the local heat transfer coefficient and the pressure drop were compared with equations known from literature; the values could be correlated with satisfactory accuracy by means of dimensionless equations. Author (ESA)

N76-20431# European Space Agency, Paris (France).

ON WAVELIKE PERTURBATIONS IN A FREE JET WHICH TRAVEL FASTER THAN THE JET FLOW

Dietrich Bechert et al Dec. 1975 35 p refs Transl. into ENGLISH of 'Ueber wellenfoermige Stoerungen im Freistrahl, die schneller laufen als die Strahlstroemung', DFVLR, Berlin Report DLR-FB-74-26, 13 Mar. 1974 Original German report available from DFVLR, Porz, West Ger, DM 13,20

(ESA-TT-211; DLR-FB-74-26) Avail: NTIS HC $4.00

The phase velocity of disturbances in a free jet at low Strouhal numbers (corresponding to low dimensionless frequencies) was investigated experimentally. Previous theoretical studies have shown that in the case of a cylindrical jet there exists a range of Strouhal numbers in which the wave velocity exceeds the velocity of the jet. These ultra rapid jet waves were analyzed experimentally for the first time. Author (ESA)

N76-20432# Advanced Technology Labs., Inc., Westbury, N.Y.

COMPRESSIBILITY EFFECTS IN FREE TURBULENT SHEAR FLOWS

S. Dash, G. Weilerstein, and R. Vaglio-Laurin Aug. 1975 38 p refs

(Contract F44620-75-C-0074)

(AD-A016535; ATL-TR-220; AFOSR-75-11436TR) Avail: NTIS CSCL 20/4

A heuristic model of compressibility effects stipulates that the fluctuating pressure-strain correlation acts to reduce the effective turbulent viscosity at the general axial station x in a compressible free shear flow by an amount uniquely dependent upon the rms Mach number fluctuation. Accordingly, the turbulent viscosity is related to the turbulent kinetic energy and the turbulent energy dissipation rate. Numerical predictions are generated for a number of standard test cases involving heterogeneous and non-equilibrium flows. Comparisons between these predictions and the experimental data are made. GRA

N76-20433# Aeronutronic Ford Corp., Newport Beach, Calif. Aeronutronic Div.

HYDRODYNAMIC STABILITY AND TRANSITION TO TURBULENCE IN THE HYPERSONIC BOUNDARY LAYER OVER A SHARP CONE Interim Report, 1 Oct. 1974 - 30 Jun. 1975

Anthony Demetriades Jul. 1975 49 p refs

(Contract F44620-75-C-0016; AF Proj. 6813; AF Proj. 9781)

(AD-A016536; AFOSR-75-1435TR) Avail: NTIS CSCL 20/4

Periodic oscillations have been observed in the laminar boundary layer of a sharp tipped, 5-degree adiabatic cone immersed in a stream of Mach no. 8. These oscillations have been photographed with a spark shadowgraph system and probed with a hot-wire anemometer. Evidence indicates that the waves are due to a hydrodynamic instability of the Tollmien-Schlichting type, active in the 2 million Reynold number. Various factors involved are discussed. GRA

N76-20434# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

TWO-DIMENSIONAL SHOCK WAVE BOUNDARY LAYER INTERACTIONS Final Report, Feb. 1973 - Sep. 1974

Robert G. Christophel Jul. 1975 61 p refs

(AF Proj. 1366)

(AD-A016469; AFFDL-TR-74-152) Avail: NTIS CSCL 20/4

A wind tunnel test was conducted in the Air Force Flight Dynamic Laboratory's High Temperature Facility to investigate the two-dimensional shock wave boundary layer interaction produced by a remote shock generator-receiver configuration. The program was conducted at a free stream Mach number of 10 and over a unit Reynolds number range of 150,000 to 600,000 per foot. The receiver plate pitch angle was 0 deg except for a portion of the program when the receiver plate was pitched to 6 deg compression to produce a local Mach number of 8 and a corresponding unit Reynolds number range of 500,000 to 2.2 million per foot. The generator plate deflection angle range was from 0 deg to 8 deg. GRA

N76-20435# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

A NUMERICAL METHOD FOR TWO-DIMENSIONAL, CAVITATING, LIFTING FLOWS

Daniel Wilson Golden May 1975 102 p refs

(Contract N00014-67-A-0204-0083; SR0090101)

(AD-A016953; TR-81512-1) Avail: NTIS CSCL 13/10

A numerical method for two-dimensional cavitating flow is developed for the flat plate. The linearized boundary value problem is restated as a set of coupled integral equations. The integral equations are approximated numerically. The numerical approximation is executed by a FORTRAN 4 computer program. The

computed results are compared to the analytic solution. This method should provide insight into developing a method for three-dimensional cavitating flows and is readily extendable to cambered profiles. GRA

N76-20436# Ballistic Research Labs., Aberdeen Proving Ground, Md.

THE SINGULAR NATURE OF THREE-DIMENSIONAL PERTURBATIONS OF BOUNDARY LAYERS AND THE SMALL CROSS FLOW THEORY

Raymond Sedney Aug. 1975 19 p refs

(DA Proj. 1T1-61101-A-91A)

(AD-A016903; BRL-1820) Avail: NTIS CSCL 20/4

Three-dimensional perturbations on two-dimensional boundary layer flows are considered. First initially induced perturbations are studied and a general solution obtained. Second a specific externally induced perturbation is discussed. In both the streamwise velocity perturbation becomes infinite but the cross flow decays as downstream infinity is approached. This implies that the small cross flow approximation is a singular perturbation. The basis for this lies in the fact that the nature of the equations is changed by the approximation, viz., the zone of dependence property is lost. GRA

N76-20437# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

NUMERICAL SOLUTION OF THE STEADY LAMINAR HYPERSONIC BOUNDARY LAYER EQUATIONS AT CHEMICAL NONEQUILIBRIUM

W. Schonauer, D. Straub, H. Spreur, and E. Adams 25 Jun. 1975 82 p refs Transl. into ENGLISH from Deut. Luft- und Raumfahrt, Forschungsbericht (West Ger.), v. 74, no. 41, 1974 p 1-77

(AD-A017197; FTD-HC-23-1164-75) Avail: NTIS CSCL 20/4

An implicit finite difference method is presented for the numerical solution of the steady laminar two-dimensional hypersonic boundary layer equations at chemical nonequilibrium. The strong nonlinearity of the energy equation and of the continuity equations due to the influence of chemical reactions requires a combination of the Newton iteration method and the method of finite differences. GRA

N76-20438# General Dynamics/Convair, San Diego, Calif.

VORTEX DEVELOPMENT AND BREAKDOWN Final Report, Apr. 1974 - May 1975

J. Raat Aug. 1975 42 p refs

(Contract F33615-74-C-3084; AF Proj. 1476)

(AD-A017039; AFFDL-TR-75-69) Avail: NTIS CSCL 20/4

A line vortex is assumed to consist of a thin viscous core of laminar embedded in an inviscid flow of uniform circulation and with axial velocity that may depend upon the distance along the core. Self-similar solutions are obtained for the particular case of an external velocity inversely proportional to the core length. These solutions exhibit linear core growth. The primary mechanism of vortex breakdown is discussed involving a fundamental incompatibility of the axial and azimuthal flow modes within the confines of a thin layer. A quantitative method is developed to predict the breakdown point in terms of initial and external aerodynamic conditions. Breakdown diagrams pertaining to flow mode incompatibility are presented for a particular family of initial core velocity profiles. Numerical examples exhibit the effect of external pressure gradients. GRA

N76-20439# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

PROTOTYPE NONLINEAR DIFFERENTIAL EQUATION FOR NONPERIODIC INSTABILITIES Interim Report

R. Gore and H. Lashinsky Aug. 1975 29 p refs

(Grant AF-AFOSR-2179-72; AF Proj. 9783)

(AD-A017588; BN-824; AFOSR-75-1511TR) Avail: NTIS CSCL 20/4

A nonlinear ordinary differential equation that describes the temporal evolution of nonperiodic instabilities, such as those that arise in convection phenomena, is developed. The role played by this prototype equation in the description of nonperiodic instabilities is the counterpart of that played by the van der Pol equation in the description of periodic instabilities. The equation is solved by singular perturbation methods and convergence problems that arise in the use of standard (Poincare) perturbation methods are indicated. The significance of terms of the form tau exp (-tau) in the approach to equilibrium is noted, these terms being analogous to the secular terms that appear in the periodic case. The prototype equation can be used as a guide in evaluating phenomena that are of possible importance as nonlinear saturation mechanisms in nonperiodic instabilities. The use of the equation is illustrated with the well-known Benard thermal instability and the inappropriate use of the conventional Landau analysis in earlier treatments of nonperiodic instabilities is indicated. GRA

N76-20440# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.

A STUDY OF PHENOMENA AND METHODS RELATING BOTH TO FLOWS IN SMALL SYSTEMS AND LARGE SCALE GEOPHYSICAL CIRCULATIONS Interim Scientific Report, 1 Jul. 1974 - 30 Jun. 1975

Harvey P. Greenspan and David J. Benney 1975 12 p refs

(Contract F44620-71-C-0110; AF Proj. 9749)

(AD-A017589; AFOSR-75-1514TR) Avail: NTIS CSCL 20/4

Research is reported on vortex shedding and instability in rapidly rotating flows, the effects of variable surface tension in immiscible fluids, and the application of numerical methods to the solution of rotating fluid problems. Discussions are also made of nonlinear stability theory, and the computational feasibility of point-vortex descriptions of planar incompressible fluid flow problems. GRA

N76-20441# Naples Univ. (Italy). Aerodynamics Inst.

FINITE ELEMENT METHODS APPLIED TO FLUID MECHANICS Final Report, 1 Apr. 1974 - 31 Mar. 1975

L. G. Napolitano Jul. 1975 63 p refs

(Grant AF-AFOSR-2074-74; AF Proj. 9781)

(AD-A017620; AFOSR-75-1527TR) Avail: NTIS CSCL 20/4

This final report presents a new formulation of free heat conduction problems in low gravity environments. The development of this theory appeared to be a necessary step before the application of finite element techniques could be studied since the conventional formulation proved not to be of general validity. GRA

N76-20442*# Stanford Univ., Calif. Dept. of Applied Mechanics.

FLUTTER OF ARTICULATED PIPES AT FINITE AMPLITUDE Interim Report

J. Rousselet and G. Herrmann Aug. 1975 30 p refs

(Grants NGL-05-020-397; AF-AFOSR-2669-74; AF Proj. 9782)

(NASA-CR-146669; AD-A017634; SUDAM-75-9; AFOSR-75-1520TR) Avail: NTIS HC $4.00 CSCL 20/4

Previous studies of the behavior of pipes conveying fluid have assumed that the fluid velocity relative to the pipe is a known quantity and is unaffected by the motion of the pipe. This approach eliminates the need to find the flow equations of motion, and is adequate for infinitesimal transverse amplitudes of motion of the pipe system, but is incapable of predicting what will be the effect of larger amplitudes. This last shortcoming may be of importance when flow velocities are near critical velocities, that is, velocities at which the system begins to flutter. It is the purpose of the present study to investigate in greater detail the dynamic behavior of pipes in the vicinity of critical velocities. GRA

N76-20443# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

ANALYTICAL THEORY OF TRANSONIC NORMAL SHOCK-BOUNDARY-LAYER INTERACTION

Sep. 1975 10 p refs Presented at the IVTAM Symp. Transonicum, Goettingen, West Germany, 8-13 Sep. 1975

(Contract N00014-72-A-0136-0001)

(AD-A017362) Avail: NTIS CSCL 20/4

This paper describes an approximate analytical theory of the nonseparating transonic interaction of a weak normal shock with an isobaric laminar or turbulent boundary layer. The resulting mixed rotation transonic flow boundary value problem is solved analytically by Fourier transformation methods. Numerical results are presented for turbulent boundary layer pressure distributions, flow geometry and skin friction. GRA

N76-20444# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.
PERFORMANCE CRITERIA FOR COOLING SYSTEMS ON AGRICULTURAL AND INDUSTRIAL MACHINES Final Report
A. E. Bergles, G. H. Junkhan, and R. L. Bunn Dec. 1974 98 p refs Sponsored by Deere and Co. Technical Center (ERI Proj. 1060-S)
(PB-246418/8; ISU-ERI-Ames-74267; HTL-6) Avail: NTIS HC $5.00 CSCL 13A

Performance evaluation criteria for heat exchangers, particularly the compact heat exchangers used in cooling systems for agricultural and industrial machines is examined. The comprehensive review of published work indicates that existing performance ratios must be modified to account for variable temperature difference between hot and cold fluids and/or the thermal resistance external to the air side. Computer programs are presented for convenient application of four criteria. A variation of the basic program is presented to handle the computation of ratios when only overall heat duty and pressure drop data are available. GRA

N76-20445# Iowa State Univ. of Science and Technology, Ames. Heat Transfer Lab.
ADVANCED COOLING SYSTEMS FOR AGRICULTURAL AND INDUSTRIAL MACHINES Final Report
A. E. Bergles, G. H. Junkhan, J. K. Hagge, and M. K. Jensen Jan. 1975 165 p refs
(PB-246417/0; ISU-ERI-Ames-75016; HTL-7) Avail: NTIS HC $6.75 CSCL 13A

Major modifications and alterations to present engine cooling systems for agricultural and industrial machines are described. Four categories of cooling system modifications were investigated; passive augmentation of standard heat exchanger cores (packed-beds, gas/solid suspensions, and spray cooling); active augmentation of standard cores, (surface scrapers, acoustic vibrations, and electric fields); new types of cooling arrangements (direct contact heat exchangers, pressurization of cooling air, and vaporization and condensation of engine coolant); and, utilization of waste heat (absorption air-conditioning systems). An extensive literature survey of heat transfer augmentation was carried out to provide the necessary data for evaluation of augmentation schemes. GRA

N76-21128 European Space Agency, Paris (France).
COMPUTATION OF THE NATURAL MODES AND FREQUENCIES OF A RIGID TANK OF ARBITRARY SHAPE PARTIALLY FILLED WITH WATER
Rabah Tahraoui *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 102-118 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 117-126 (For availability see N76-21123 11-99)

N76-21136 Metallwerk Elisenhuette G.m.b.H., Nassau (West Germany).
EMPIRICAL CALCULATION OF BUBBLES OF SUBMERGING BODIES OF REVOLUTION
R. F. Steffen *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 119-128 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21142 Studiengruppe Ballistik Schrobenhausen (West Germany).
THE FLOW IN A DETONATING EXPLOSIVE TUBE
E. H. Jager and F. R. Thomanek *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 183-194 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21144 Metallwerk Elisenhuette G.m.b.H., Nassau (West Germany).
UNDERWATER DETONATION WITH MULTIPLE EXPLOSIVE CHARGES
H. G. Bugiel *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 207-214 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21146 Ernst-Mach-Inst., Freiburg (West Germany).
SHOCK WAVE PROPAGATION THROUGH BRANCHED DUCTS
W. Heilig and H. Reichenbach *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 229-239 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-20446 Illinois Univ., Urbana.
THE DEVELOPMENT AND APPLICATION OF AN AUTOMATED MULTIELEMENT ATOMIC EMISSION/ATOMIC FLUORESCENCE FLAME SPECTROMETER Ph.D. Thesis
Robert William Spillman 1975 321 p
Avail: Univ. Microfilms Order No. 76-6973

An analysis of the various compromises made in developing a multielement technique is presented. Various methods of optimization employed in reducing the effects of these compromises are evaluated, and some current multielement approaches are analyzed in light of the conclusions drawn. The hybrid atomic emission/atomic fluorescence spectrometer described is constructed from a commercially available flame spectrometer and is interfaced to a PDP 8/L minicomputer. This system operates in a sequential mode and the use of the computer enables the setting of optimum conditions for each element through programmed flames, monochromator wavelength and slit width selection, wavelength modulation, hollow cathode lamp on-off periods, autoranging photomultiplier tube, and data acquisition and reduction techniques. The use of a rotatable quartz plate for wavelength modulation provides a means for automatically calibrating the monochromator, a method for accurate peak positioning, and the capability for background correction for emission measurements. Dissert. Abstr.

N76-20447+ Riber, Paris (France). Dept. Analyse.
RESEARCH AND DEVELOPMENT OF TWO AUGER SPECTROMETERS Final Report [ETUDE ET MISE AU POINT DE DEUX MODELES DE SPECTROMETRES AUGER]
Claude Buisson 15 Jun. 1975 42 p In FRENCH
(Contract DGRST-72-7-0153)
Avail: NTIS HC $4.00

Spectrometers for surface analysis are described. The first one consists of a charged particle analyzer with retarding electric field associated with a low energy electron diffractor. The second one is an electrostatic velocity analyzer with radial field and cylindrical mirror configuration. To these instruments were associated the ancillary subsystems with ultra vacuum chambers, ion gun, manipulator, and variable temperature sample holder. The instruments are readily usable in association with other analysis methods such as secondary ion spectroscopy, ellipsometry, and ESCA. ESA

N76-20448+ Compagnie Generale d'Electricite, Marcoussis (France). Dept. d'Energie.
LOSS MEASUREMENT IN SUPERCONDUCTOR MATERIALS FOR HIGH CURRENT DENSITIES SUBJECTED TO CURRENT AND FIELD VARIATIONS AS FOR CRYOALTERNATORS Final Report [MISE AU POINT D'UNE METHODE DE MESURE DES PERTES PRESENTEES PAR DES CONDUCTEURS SUPRACONDUCTEURS DE HAUTE INTENSITE SOUMIS A DES VARIATIONS DE CHAMP ET DE COURANT QUI SERONT RENCONTREES DANS LE CAS DES CRYOALTERNATEURS]
Pierre Dubois Jul. 1974 22 p In FRENCH
(Contract DGRST-73-7-1456)
Avail: NTIS HC $3.50

A loss measurement method applicable to high intensity superconductors subjected to low frequency variable induction is presented. An electrical method is used to determine the losses by integration of the volt ampere product over time. The product is obtained by analog multiplication and integration performed numerically. The input current to the samples is monitored by a system, which is described in detail. Calibration was performed with a copper coil at liquid helium temperature. A 4% precision was obtained for an energy measurement of 4 microjoule. ESA

N76-20449*# Old Dominion Univ. Research Foundation, Norfolk, Va. Dept. of Physics and Geophysical Sciences.

DETERMINATION OF TRANSFER FUNCTION OF COPE CORRELATION INTERFEROMETER INSTRUMENT

Jerold Twitty and Earl C. Kindle Mar. 1976 15 p
(Grant NsG-1131)
(NASA-CR-146570; PGSTR-PH76-26) Avail: NTIS HC $3.50 CSCL 14B

The comparison of theoretical and instrument response functions and its use as a procedure for determining the transfer function of the COPE correlation interferometer are summarized. Data show qualitative agreement can be obtained when discrepancies between theory and instrument are investigated and instrument components are analyzed in detail. Data were obtained using a set of calibration data and computer algorithms. Author

N76-20450# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Antriebssysteme.

SPECTROSCOPIC TEMPERATURE DETERMINATION AFTER THE 2-LINE METHOD FOR TIME-VARYING TEMPERATURES

Rudolf Ferdinand Neubauer 13 Oct. 1975 30 p refs In GERMAN; ENGLISH summary Sponsored by Deut. Forschungsgemeinschaft Report will also be announced as translation
(DLR-FB-75-65) Avail: NTIS HC $4.00; DFVLR, Cologne DM 13

Theoretical analysis and experimental results indicate that spectroscopic temperature measurements following the 2-line method - applying an integrating rather than a time-resolving technique - yield both too high and too low temperatures, if the temperature in the gas varies with time. Temperatures were measured for a rotating arc (T = 8,000 K and T = 12,000 K) and within a hot jet (T = 6,000 K). Author (ESA)

N76-20451# Thomson-CSF, Velizy (France). Div. Tubes Electroniques.

ASSESSMENT OF POSSIBILITIES TO REALIZE A TUNABLE OSCILLATOR IN THE DECIMILLIMETRE RANGE Final Report

P. Gosset, G. Kantorowicz, P. Palluel, and A. M. Shroff Nov. 1975 113 p refs
(Contract ESTEC-2335/74-PP)
(TR-1.507-T; TRH-2.139; ESA-CR(P)-758) Avail: NTIS HC $5.50

Possibilities of realizing tunable backward wave (or similar) oscillators for heterodyne detection of submillimeter infrared radiation were assessed. Improvement of the carcinotron performance in order to reach the minimum power level of 10 mW in the required wavelength range 1 to 0.25 mm, together with an enlarged bandwidth of about 25 % for reducing the total number of tubes necessary to cover the whole frequency range, seems possible, leading to six tubes for a full frequency coverage. For wavelengths below 0.5 mm the cascaded carcinotron is identified as the most suitable concept. Phase-locked loop stabilization experiments on an 8 mm carcinotron have proven the ability of stabilizing a carcinotron signal. Author (ESA)

N76-20452# General Electric Co., Ltd., Wembley (England).

DEVELOPMENT OF A CCD IMAGE SENSOR, PHASE 1 Final Report

D. J. Burt, H. T. Brown, R. A. Harris, and F. R. Badcock Nov. 1975 104 p refs
(Contract ESTEC-2256/74-AK)
(Rept-16194C; ESA-CR(P)-777) Avail: NTIS HC $5.50

The results of work carried out in the development of a CCD image sensor are described. Topics included are: basic studies of buried channel technology, experiments with chip thinning, experiments with on-chip charge detecting circuitry, fabrication and optical assessment of linear arrays for both front face and back face imaging, and studies of antiblooming. From these results, consideration is given as to the feasibility of meeting target performance specifications for space imagers. Author (ESA)

N76-20453# European Space Agency, Paris (France).

METHOD FOR THE ANALYSIS OF LASER DOPPLER SIGNALS WITH THE AID OF A COMPUTER

Jens-Carsten Petersen Nov. 1975 57 p refs Transl. into ENGLISH of 'Eine Methode zur Anal. digitalisierter Laser-Doppler-Signale mit Hilfe eines Rechners', DFVLR, Porz, West Ger. Report DLR-Mitt-75-07, 7 Mar. 1975 Original German report available from DFVLR, Porz, West Ger. DM 24,70
(ESA-TT-208; DLR-Mitt-75-07) Avail: NTIS HC $4.50

To supplement existing systems for the analysis of laser Doppler signals, a method was developed for performing the signal analysis with the aid of a computer. In principle, the program classifies the digitized signals and evaluates the mean frequency of those judged valid. The method can be used either on-line, without storage of the raw data, or in an off-line mode, storing the raw data before performing data reduction. The programs produced are described together with a brief description of system-dependent errors. Author (ESA)

N76-20454# AeroChem Research Labs., Inc., Princeton, N.J.

CHEMILUMINESCENT REACTIVE HYDROCARBON ANALYZER FOR MOBILE SOURCES Final Report, 13 Jun. 1973 - 12 Jun. 1975

A. Fontijn, H. N. Voltrauer, and R. Ellison Jun. 1975 82 p refs
(Contract EPA-68-02-1224)
(PB-245126/8; EPA-650/2-75-069; TP-319a) Avail: NTIS HC $5.00 CSCL 14B

A chemiluminescence method for measuring total reactivity of hydrocarbon (HC) mixtures has been developed and a prototype analyzer based on this method has been built. The difference between the OH emission intensities at 308.9 and 312.2 nm from O-atom/hydrocarbon reactions near 1 Torr is measured. The other hydrocarbons tested yield the same spectral distributions as C2H4;CH4 yields no emission. Two PMTs are used for 308.9 and 312.2 nm measurement respectively. When the apparatus is zeroed, the difference in signal from the two PMTs is insensitive to C2H2. The relative response to the individual reactive HC species can be set to give good agreement with reactivity ratings. The response to HC mixtures is additive. CO, CO2, SO2, CH4, C2H2 and NOx do not interfere with instrument response. A 1% change in (O2) causes < 1% change in signal; 3% H2O causes a 12% decrease. GRA

N76-20455# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.

TESTING A FLUIDIC TEMPERATURE SENSOR ON A SUBSCALE RAMJET ENGINE COMBUSTION CHAMBER Technical Report, Sep. - Dec. 1973

John T. Hojnacki Jun. 1975 135 p refs
(AF Proj. 3012)
(AD-A016455; AFAPL-TR-75-1) Avail: NTIS CSCL 13/7

Data obtained from 26 tests that used three fluidic temperature sensors to measure gas temperatures in a subscale ramjet engine combustion chamber are presented. The test variables for the combustion chamber were chamber pressure and chamber temperature. Tests were conducted using nominal chamber pressures of 35 and 70 psia and chamber total temperatures of 2500 R, 3000 R, and 3800 R. One of the sensors used various insulator materials which were magnesium oxide, Hastelloy X, and zirconium oxide. These materials varied the conduction heat losses from the sensor body to the outer case. The mass flow through a sensor was increased by a factor of three to see if improvements could be made in reducing steady state error or increasing thermal response. Lastly, one test was conducted using an ablative lined combustion chamber that provided a long duration run. GRA

N76-20456# Army Engineer Topographic Labs., Fort Belvoir, Va.

ENGINEER TESTS OF 2.5X REDUCTION PRINTER Technical Report, Apr. - Oct. 1974
Frederick C. Myers Apr. 1975 44 p
(AD-A016924; ETL-ETR-74-7) Avail: NTIS CSCL 14/5

The report covers the results of Engineer Tests on the 2.5X Reduction Printer, fabricated under contract by Latady Instruments, Inc., for production use by the DMA Topographic Center (DMATC). The printer was developed to give DMATC the capability of reducing 6.6-inch wide, high resolution, roll film imagery input to 70mm-wide roll film imagery output, while maintaining high resolution and low distortion. The printer was tested against the approved DMATC technical characteristics using a test belt containing a wide variety of photographic test subjects as inputs, such as low-contrast resolution targets, gray scales, calibrated grids, step wedges, and good quality large-scale imagery. The report concludes that the printer meets all the requirements of the Technical Characteristics, with the exception of resolution. The printer produced an average resolution of 103.5 lines per mm (2:1 TOC contrast), while a minimum of 130 lines per mm (2:1 TOC contrast) was required. The problem of Newton rings on the output film can be reduced by placing tape at the two outside edges of the input glass drum. Total elimination of the Newton ring problem will require a major redesign of the optical system to prevent the scattering of light between the outside surface of the glass input drum and the surface of the input film. GRA

N76-20457# Picatinny Arsenal, Dover, N.J.
POSITION DETECTION FOR PNEUMATIC CYLINDERS
Joseph Lebzelter Sep. 1975 12 p refs
(AD-A016862; PA-TM-2169) Avail: NTIS CSCL 13/7

The two most widely used techniques for position detection on pneumatic logic controlled production equipment are the use of limit valves and of sequencing. These techniques are also suitable for use with fluidic logic. This report describes a new technique of position detection by determining the location of cushioning in a pneumatic cylinder, as recently developed by the Ammunition Engineering Directorate, Picatinny Arsenal. It also includes a comparison of that technique with the widely used one employing limit valves and sequencing. GRA

N76-20458# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
FORCE TRANSDUCERS FOR DUAL RAIL SLEDS Final Report, 30 Nov. 1973 - 30 Jun. 1975
William E. Baker Jul. 1975 57 p
(Contract F29601-74-C-0025)
(AD-A016462; ME-65(75)-AF-292-1; AFSWC-TR-75-56) Avail: NTIS CSCL 14/2

A description of the work undertaken for the two tasks of the contract is given. The first task required the design and development of instrumentation for special force transducers for the narrow gage dual rail sled, and instrumentation of four of these units for use during the sled runs. Two components of force were to be measured, the vertical and cross-track components. The transducer hardware was to be furnished by another agency. Due to delays in fabrication of the hardware, it was possible to complete only the design and development phase work. Recommendations for the final design are given. The second task required design, development, and manufacture of force transducers for measurement of the cross-track forces on a large dual rail sled. The transducers developed for this task are described. These transducers also have the capability of measuring the vertical forces. Results of calibration tests and combined load tests are given, and the documentation shows the units developed meet the specified contract requirements. GRA

N76-20459# Naval Ship Research and Development Center, Bethesda, Md. Central Instrumentation Dept.
EIGHT CHANNEL PORTABLE DATA ACQUISITION SYSTEM (SESPODAS)
Robert D. Pierce and Glenn Friendenreich Aug. 1975 84 p
(AD-A016421; CID-29-3) Avail: NTIS CSCL 09/2

A portable data acquisition system was developed to record eight channels of model or full scale naval craft motion data. Six of the eight channels are dedicated to record roll angle, pitch angle, heave acceleration, surge acceleration, and sway acceleration signals provided by the system's transducers, and audio information (voice). Signals from two additional transducers, one of which can be the yaw rate signal provided by the system, can be recorded on the two remaining channels. This report discusses the system's features and installation, operation and maintenance procedures. Author (GRA)

N76-20460*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
DEVELOPMENT OF AN OPTICAL CARBON MONOXIDE DETECTOR Final Report, Jul. 1972 - Sep. 1973
Burton Scott Aug. 1975 64 p ref Sponsored in part by NASA
(Contract DI-BM-HO-122074)
(NASA-CR-146556; PB-246570/6; SPO-30017; BM-OFR-93-75) Avail: NTIS HC $4.50 CSCL 14B

A device for detecting carbon monoxide at ppm levels is described which is based on the measurement of infrared absorption at 4.65 microns. The optical design of the detector incorporates a confocal cavity which has the effect of reducing the total amount of radiation passing to the detector, but at the same time increasing the percent attenuation observed when adding CO, by a factor called gain. The radiation is chopped by a filter wheel which contains narrow band filters at 4.0 and 4.65 microns. The resultant signal produced by the pyroelectric detector is demodulated by the electronics to produce an automatic gain control signal, proportional to the total radiation, and a difference signal, proportional to the CO present. Tests of a breadboard model are described. GRA

N76-21135 Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (West Germany).
MEASUREMENT OF THE SPATIAL DISTRIBUTION AND THE VELOCITY DISTRIBUTION OF FRAGMENT CLOUDS AND SHOT GRAINS
M. Held and P. Nikowitsch *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 87-117 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21141 Institut Franco-Allemand de Recherches, St. Louis (France).
RECORDING OF TRANSIENT PHENOMENA USING A STREAK CAMERA AND A HIGH-EXPLOSIVE DRIVEN FLASH
Y. DeLongueville *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 173-182 In FRENCH; ENGLISH summary (For availability see N76-21129 11-99)

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-20461 Illinois Univ., Urbana.
HIGH POWER OPTICALLY PUMPED FAR INFRARED LASER SOURCES Ph.D. Thesis
Thomas Kent Plant 1975 120 p
Avail: Univ. Microfilms Order No. 76-6907

An optically pumped methyl fluoride (CH3F) laser with a very slowly diverging spatially and temporally smooth beam and producing 20% of the Manley-Rowe limit is analyzed. A well moded CW optically pumped FIR waveguide laser is the local oscillator and is amplified in a single pass cell from 1-3 m long by a CO2 TEA laser pump. An output of approximately .2 mJ 496 microns radiation is obtained for a CO2 input of approximately 80 mJ and the FIR beam follows the smooth, single moded TEA laser pulse in space and time. A simple one mirror feedback system and a waveguide cavity are also examined. The one mirror feedback with no local oscillator required is shown to produce the highest power and most efficiency and is suggested as a plasma diagnostic tool. A theoretical rate-equation model is presented which is in excellent agreement with experiment. The most recent optical constants for CH3F are also presented. A scaling calculation shows that a 1 MW smooth (spatially and temporally) FIR pulse is possible using a CO2 pump energy <15 J in a cell 3 m long by 15 cm in diameter. Dissert. Abstr.

N76-20462 Alabama Univ., University.
STUDY OF OPTICAL-FREQUENCY-SENSITIVE RF BEAT NOTES IN INTRACAVITY PHASE MODULATED LASERS Ph.D. Thesis
Richard Alan Curtis 1975 106 p
Avail: Univ. Microfilms Order No. 76-4805

The properties of a phase modulated, single mode laser are examined. In particular, it is shown theoretically and experimentally that such a laser produces a signal which can be used in a closed loop system to control the laser output frequency. The theory includes results of a nonlinear computer solution of the coupled differential equations which describe the laser system. The computer solutions give the time dependence and certain radio frequency envelope characteristics of the laser output. It is shown that the radio frequency component of the output envelope which is at the modulation frequency has a sharp null when the laser mode having gain is at the atomic line center frequency. Certain conditions which limit the effect are investigated. A linearized expression for the radio frequency signal characteristic is developed and applied to the case of modulation of a multimode laser at a specialized frequency. It is shown that a single mode type of characteristic can be made to occur in a multimode laser. Dissert. Abstr.

N76-20463 Illinois Univ., Urbana.
LIQUID-PHASE-EPITAXIAL GROWTH AND PROPERTIES OF INDIUM GALLIUM PHOSPHIDE AND INDIUM GALLIUM PHOSPHIDE ARSENIDE INJECTION LASERS Ph.D. Thesis
William Robert Hitchens 1975 119 p
Avail: Univ. Microfilms Order No. 76-6798

Single crystal layers of Inl-xGaxP and Inl-xGaxPl-zAsz have been grown by constant-temperature liquid-phase-epitaxy (CT-LPE) on GaAs and GaAsl-yPy substrates. Because of the high quality of these LPE layers, it has been possible to study: (1) the crystal and defect properties of Inl-xGaxP and Inl-xGaxPl-zAsl, (2) the energy gap as a function of crystal composition, (3) spontaneous and stimulated photoluminescence well into the visible, (4) yellow homojunction lasers in the ternary, and (5) yellow double heterojunction lasers in the quaternary. It is shown that the quaternary Inl-xGaxPl-zAsz offers considerable promise as a laser and LED material, with output at the peak of the eye's sensitivity. Dissert. Abstr.

N76-20464*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE DELTA DOPPLER TECHNIQUE FOR LDV MEASUREMENTS AT LONG DISTANCES
William C. Cliff Feb. 1976 14 p refs
(NASA-TM-X-64996) Avail: NTIS HC $3.50 CSCL 20E

A technique for measuring velocity, referred to as a Delta Doppler technique, was presented. This technique determines scattering source velocities by measuring the difference in Doppler shifts of two different frequencies. By transmitting the two frequencies along the same path, a moving fringe pattern is established such that a nonmoving scatterer at the sensing volume would see an intensity variation exactly equal to the difference in the transmitted frequencies. If the particle has a velocity component along an axis which bisects the angle formed by the transmitter and receiver axes, a Doppler shift in the difference frequency can be measured and the velocity component computed. The frequency measured would correspond to the difference in Doppler frequencies that two laser Doppler velocimeters using separate frequencies (the same frequencies as used previously) would have measured, thus the term Delta Doppler. Author

N76-20465*# National Aeronautics and Space Administration, Washington, D.C.
OPTICS AND LASERS: A COMPILATION Technology Utilization
Jan. 1976 31 p
(NASA-SP-5973(02)) Avail: NTIS HC $1.00 CSCL 20E

A number of innovative devices and techniques in optics and related fields were presented. The following areas were covered: advances in laser and holography technology, articles on spectroscopy and general optics, new information in the area of photography. Author

N76-20466*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WIDEBAND HETERODYNE RECEIVER FOR A LASER COMMUNICATION SYSTEM Patent Application
Bernard J. Peyton (Airborne Instr. Lab., Long Island N. Y.), Theodore Flattau (Airborne Instr. Lab., Long Island, N. Y.), John M. Wolczok (Airborne Instr. Lab., Long Island, N. Y.), John W. Mellars (Airborne Instr. Lab., Long Island, N. Y.), and Ronald A. Lange, inventors (to NASA) (Airborne Instr. Lab., Long Island, N. Y.) Filed 18 Mar. 1976 22 p
(Contracts NAS5-23119; NAS5-23183)
(NASA-Case-GSC-12053-1; US-Patent-Appl-SN-667930) Avail: NTIS HC $3.50 CSCL 20E

A wideband heterodyne receiver for a laser communication system is disclosed which includes a front end with a cooled photomixer contained in a hermetically sealed space quality housing designed for wide bandwidth transmission. The photomixer is coupled through a wideband preamplifier to the receiver back end which includes a frequency tracking network and demodulating equipment. The receiver is capable of tracking a doppler frequency shift of 750 MHz, positive or negative, and has an instantaneous intermediate frequency information bandwidth of 400 MHz. The receiver system is also capable of operating over a wide temperature range and is designed to be suitable for use in outer space communication. NASA

N76-20467# California Univ., Livermore. Lawrence Livermore Lab.
SCALING OF ELECTRON BEAM SOURCES FOR LASER FUSION APPLICATIONS
L. G. Schitt and L. P. Bradley 21 Jul. 1975 68 p refs
(Contract W-7405-eng-48)
(UCID-16864) Avail: NTIS

The purpose of the study is to develop a scheme for constructing electron beam machines capable of pumping large volumes of gas, to analyze their performance within the framework of existing knowledge of the physical mechanisms involved, to use this analysis to assess the viability of the overall concept, pinpoint weakness in the understanding of the physics, identify the most important limiting physical processes, and hence to propose a program to prepare for the eventual construction of a large scale gas laser system. Author

N76-20468# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF RF PLASMA LIGHT SOURCES FOR DYE LASER EXCITATION
J. S. Kendall and J. E. Jaminet Jun. 1975 70 p refs Sponsored by ERDA
(UCRL-13656) Avail: NTIS HC $6.50

Analytical and experimental studies were performed to assess the applicability of radio frequency (RF) induction heated plasma light sources for potential excitation of continuous dye lasers. Experimental efforts were directed toward development of a continuous light source having spectral flux and emission characteristics approaching that required for pumping organic dye lasers. Analytical studies were performed to investigate (1) methods of pulsing the light source to obtain higher radiant intensity and (2) methods of integrating the source with a reflective cavity for pumping a dye cell. NSA

N76-20469# Johns Hopkins Univ., Baltimore, Md. Dept. of Chemistry.
FAR INFRARED CHEMICAL LASERS Progress Report, 1 Dec. 1974 - 31 Jul. 1975
D. W. Robinson Aug. 1975 53 p refs
(Contract E(11-1)-2523)
(COO-2523-2) Avail: NTIS HC $5.75

Flash photolysis of selected mixtures of O3/H2O/O2 and O3/H2 in laser cavity results in far infrared stimulated emission principally at 357/cm and 286/cm respectively. Experimental and computational studies of these systems established the pumping mechanisms. This work shows the selectivity of both an energy transfer pumping mechanism and an energy of reaction pumping mechanism which in both cases energy matches govern narrowly the upper state in which the inversion builds. Concurrently, the design and fabrication of a laser cavity of twice the length and 25 times the mode volume has proceeded. The goal

of this one is chemical pumping of the HCN laser at 30/cm. This device has been carried to within, perhaps, three months of becoming operational. NSA

N76-20470# Los Alamos Scientific Lab., N.Mex.
LASER SYSTEMS FOR HIGH PEAK-POWER APPLICATIONS
C. Fenstermacher 1975 9 p refs Presented at the Seminar on Opt. Methods in Energy Conversion, Rochester, N. Y., 23 Jun. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1757; Conf-750666-2) Avail: NTIS HC $4.00

Large scale programs are under way at major laboratories to study the feasibility of laser-induced fusion. The laser requirements for this investigation are formidable and it is estimated that powers in the range of 100 terrawatts with total energies of 100,000 to 1,000,000 joules may be needed. A major fraction of the effort was directed toward the development of high-energy short-pulse lasers which can meet these requirements. The parameters, of the CO2 laser system were extensively studied and it appears that the efficiency, energy density, bandwidth, and optical damage limits are compatible with the requirements. The scaling laws are also now well understood. Based upon these results, several large carbon dioxide systems were developed by the Los Alamos Scientific Laboratory. NSA

N76-20471# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
THEORY OF HIGH SUBSONIC FLOW CO ELECTRIC DISCHARGE LASERS Final Technical Report, Feb. 1974 - Jul. 1975
Neill S. Smith and H. A. Hassan Jul. 1975 118 p refs
(Grant NSF GK-41610)
(PB-246057/4; NCSU-MAE-TR-75-1) Avail: NTIS HC $5.50 CSCL 20E

A self-consistent model for high subsonic flow electric discharge CO laser systems with coincident optical and flow axes is presented. The model employed here couples the kinetics of the electrons and heavy particles with the optical and fluid dynamic processes in the laser system. The resulting integro-differential system of equations governing this multi-level system is solved by an exact numerical scheme. The effects of composition, total mass flow rate, inlet temperature and pressure, mirror reflectivity and input power on the maximum average small signal gain coefficients, the intensities and the efficiency are examined. The results indicate that for a given input power and N2 fraction, the efficiency increases by reducing the inlet temperature and increasing the velocity and/or the fraction of CO. Moreover, transitions on the lower vibrational bands can be obtained at the expense of lower efficiencies by reducing the CO fraction. GRA

N76-20472# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AUGER ANALYSIS OF THREE ENHANCED MULTILAYER DIELECTRIC MIRROR DESIGNS Physical Sciences Research Papers
William S. Ewing 13 Jun. 1975 17 p ref
(AF Proj. 5620)
(AD-A016426; AFCRL-PSRP-637) Avail: NTIS CSCL 20/5

Three multilayer dielectric enhanced laser mirror designs have been analyzed using Auger Spectroscopy. Particular care was taken to characterize all layers and interfaces for contamination and composition. The designs characterized were found to be ZnSe/ThF4 multilayers of four and five pair stacks. Principal contaminants were identified as oxygen and for the case of ZnSe layers, sulfur. Author (GRA)

N76-20473# Martin Marietta Aerospace, Orlando, Fla.
LASER RELIABILITY PREDICTION Final Technical Report, 27 Dec. 1973 - 28 Feb. 1975
T. R. Gagnier, E. W. Kimball, and R. R. Selleck Griffiss AFB, N. Y. RADC Aug. 1975 128 p refs
(Contract F30602-74-C-0091; AF Proj. 5519)
(AD-A016437; OR-13667; RADC-TR-75-210) Avail: NTIS CSCL 20/5

This report presents the results of a program to locate, collect, and analyze laser reliability data, to construct laser reliability models, and to prepare revision sheets suitable for inclusion as a revision of Section 2.4, Lasers, in Mil-HDBK-217B. The report describes the methodology, analyses, models, failure rates, factors, and ground rules involved in the effort. It summarizes 10 million item-hours and 4 billion item-pulses of operating data collected from a sample of 1321 lasers, 2206 laser diodes, and 1750 laser subassemblies. Lasers discussed in detail include argon ion, flowing CO2, sealed CO2, dye, helium/cadmium, helium/neon, heterojunction, gallium arsenide injection, solid state, and transversely excited atmospheric pressure lasers. Major laser subassemblies, parts, and components are also included. In addition, the discussion covers failure modes and mechanisms; design criteria and notes; manufacturing criteria, problems, and burn-in; quantitative math models; failure rates; and life characteristics. A detailed bibliography and a list of data sources and contributors are included. GRA

N76-20474# Naval Postgraduate School, Monterey, Calif.
THE DEVELOPMENT OF AN OPTICALLY ACTIVE LASER SCHLIEREN SYSTEM WITH APPLICATION TO HIGH PRESSURE SOLID PROPELLANT COMBUSTION M.S. Thesis
James Randolph Andrews Sep. 1975 79 p refs
(AD-A016446) Avail: NTIS CSCL 21/2

A laser schlieren system, using an optically active single-piece quartz prism-polaroid sheet combination aperture in place of the conventional knife edge, was developed and applied to high pressure solid propellant combustion studies. Advantages and limitations of the system are discussed. Ammonium perchlorate deflagration was observed to pressures of 2500 psi. Distinct surface reaction sites were evidenced in the gas phase at high and low pressures by alternating density gradients across the surface. These sites were found to be very small or nonexistent at intermediate pressures. GRA

N76-20475# Texas Univ., Austin. Applied Research Labs.
EXPERIMENTAL INVESTIGATION OF THE LASER-EXCITED THERMOACOUSTIC ARRAY IN WATER Final Report, 1 Apr. 1973 - 31 Dec. 1974
C. Robert Culbertson 23 Sep. 1975 74 p refs
(Contract N00014-70-A-0166-0015; NR Proj. 261-187)
(AD-A017372; ARL-TR-75-51) Avail: NTIS CSCL 20/13

An experimental evaluation of the Westervelt-Larson theory for the pressure and directivity of the laser-excited thermoacoustic array in water has been conducted. Instrumentation includes a modulated laser system that operates at 0.6943 micrometer and 1.06 micrometers, with a modulated frequency range of 5 to 80 kHz. Apparatus and methods for measuring the attenuation of light in water at the optical wavelengths of interest have also been implemented. An existence test confirmed that an acoustic signal is produced by thermalization of modulated laser light in lake water. The sound is generated in a beam with a measured half-power angle theta that is in reasonable agreement with theoretical prediction. The source level is a linear function of laser output power and measured absolute values of source level are in good agreement with theory. It may be concluded that the Westervelt-Larson theory is a valid model for predicting the pressure and directivity of the laser-excited thermoacoustic array in water. GRA

N76-20476# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VISIBLE CW AND LONG-PULSE LASING IN S 2 AND S 3 Final Report, Aug. 1971 - Nov. 1974
Robert A. Dessert Dec. 1974 261 p refs
(AD-A017217; DS/PH/74-2) Avail: NTIS CSCL 20/5

The sulfur ion laser was investigated in three slotted-hollow cathode and two flowing positive column laser (PCL) configurations. Laser action was achieved only in the PCL configurations. In the 1.76-mm diameter x 500-mm long laser, true CW operation was achieved on 9 green transitions in S II. Quasi-CW operation in the PCL at 4-ms pulse lengths occurred on 15 S II and 2 S III transitions covering the range from 4925- to 5819-A. A new laser transition at 5011.6A in S II was discovered. Spontaneous and TEM00 laser intensity vs. discharge current up to 17 amps were measured. Small signal gains were 40% to 60% per meter for the stronger lines. Optimum output mirror transmission was about 7% producing 250-mw TEM00 and

500-mw multimode multiline power. Optimum operation was at 0.6 torr Ne buffer gas flowing over sulfur crystals at 116C at 0.25 torr cc/sec. The excitation mechanism for the laser transitions is definitely by electron impact. Approximate calculations suggest that the electron temperature may be 5- to 10-eV and the order-of-magnitude cross section for direct electron excitation of the 5454-A upper level from the ground state of neutral S is 10 to the minus 17 power to 10 to the minus 16 power -cm2. GRA

N76-20477# Northeastern Univ., Boston, Mass.
DEVELOPMENT OF A LASDEC SYSTEM MODEL Final Report, 1 Nov. 1973 - 31 Jul. 1974
Richard E. Grojean Sep. 1975 47 p refs
(Contract DAHC04-74-G-0042)
(AD-A017646; ARO-12101.1-RTL) Avail: NTIS CSCL 20/5

The effect of pulsed laser excitation on selected dye systems was studied to determine the optimum pulse parameters for enhancement of fluorescence yield. Luminescence decay under continuous laser illumination was also studied by rapid scan spectrophotometry. GRA

N76-20478# Pittsburgh Univ., Pa. Space Research Coordination Center.
SPECTROSCOPIC STUDIES OF THE CHARGE TRANSER REACTIONS He(+) + Hg YIELDS He+ (Hg(+))* AND He2(+) + N2 YIELDS 2He+ (N2(+))*
Edward Graham, IV, Manfred A. Biondi, and Rainer Johnsen 16 Oct. 1975 22 p refs
(Contract N00014-67-A-0402-0010; ARPA Order 2686)
(AD-A017088; SRCC-216; APP-53) Avail: NTIS CSCL 20/5

The reactions He(+) + Hg yields He + (Hg(+))* and He2(+) + N2 yields 2He + N2(+)* have been studied at thermal energy in a drift tube-mass spectrometer apparatus fitted with a sapphire window for observing the light emitted from the electronically excited ions. For the first reaction, over the wavelength range 300-900 nm, the only emissions observed from the (Hg(+))* product ions are the 614.9 nm and 794.4 nm transitions, in approximately equal amounts. This equal branching in the case of reaction paths having substantially different energy defects, is not explained by present theoretical models of the charge transfer process. For the second reaction, the emissions observed from the (N2(+))* product ions are from the first negative transition; the most intense lines observed and their corresponding vibrational levels are 391.4 nm (0,0) 427.8 nm (0,1), 470.9 nm (0,2), 522.8 nm (0,3) and 358.2 nm (1,0). The strongest of these lines is the 391.4 nm transition, with only a small intensity originating from the first vibrational level of the B2 Sigma(+)u suggesting that undistorted Franck-Condon factors control the N2 excitation-ionization during the charge transfer. GRA

N76-20479# Stanford Research Inst., Menlo Park, Calif.
STUDY OF NEW CHEMICAL LASER SYSTEMS Semiannual Technical Report, 8 Feb. - 8 Aug. 1975
D. J. Eckstrom, S. A. Edelstein, D. L. Huestis, B. E. Perry, and S. W. Benson Sep. 1975 75 p refs
(Contract DAAH01-74-C-0524; ARPA Order 1180)
(AD-A017011; SRI-MP75-44; SATR-3) Avail: NTIS CSCL 20/5

The authors report experimental and analytical studies aimed at development of visible chemical lasers. It was found that Ba atoms quench BaO* with a gas-kinetic rate. This quenching will be a serious loss mechanism in a steady-state flame at conditions of laser threshold. Metal atom quenching appears to give statistical distributions of Ba* states. Modeling studies show that a steady-state electronic population inversion is unlikely even without quenching processes because of vibrational relaxation in the ground electronic state. These results taken together suggest the importance of studying premixed, pulsed reactions where both the reactant quenching problem and the vibrational relaxation problem may be avoided. Numerical solutions of the multiple reaction spherical diffusion flame problem pertinent to chemiluminescence studies are presented and discussed. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-20480* National Aeronautics and Space Administration. Pasadena Office, Calif.
ZERO TORQUE GEAR HEAD WRENCH Patent
Allan R. McDougal (JPL) and Robert M. Norman, inventors (to NASA) (JPL) Issued 9 Mar. 1976 6 p Filed 10 Oct. 1974 Sponsored by NASA
(NASA-Case-NPO-13059-1; NASA-Case-NPO-13436-1; US-Patent-3,942,398; US-Patent-Appl-SN-513690; US-Patent-Class-81-56; US-Patent-Class-81-57.31) Avail: US Patent Office CSCL 13I

A gear head wrench particularly suited for use in applying torque to bolts without transferring torsional stress to bolt-receiving structures is introduced. The wrench is characterized by a coupling including a socket, for connecting a bolt head with a torque multiplying gear train, provided within a housing having an annulus concentrically related to the socket and adapted to be coupled with a spacer interposed between the bolt head and the juxtaposed surface of the bolt-receiving structure for applying a balancing counter-torque to the spacer as torque is applied to the bolt head whereby the bolt-receiving structure is substantially isolated from torsional stress. As a result of the foregoing, the operator of the wrench is substantially isolated from any forces which may be imposed.
Official Gazette of the U.S. Patent Office

N76-20481*# Bell Aerospace Co., Buffalo, N.Y.
INVESTIGATION OF ELECTROFORMING TECHNIQUES Final Report, Jun. 1974 - Dec. 1975
G. A. Malone Dec. 1975 131 p refs
(Contract NAS3-17823)
(NASA-CR-134959; BAC-8756-953003) Avail: NTIS HC $6.00 CSCL 13H

Copper and nickel electroforming was examined for the purpose of establishing the necessary processes and procedures for repeatable, successful fabrication of the outer structures of regeneratively cooled thrust chambers. The selection of electrolytes for copper and nickel deposition is described. The development studies performed to refine and complete the processes necessary for successful chamber shell fabrication and the testing employed to verify the applicability of the processes and procedures to small scale hardware are described. Specifications were developed to afford a guideline for the electroforming of high quality outer shells on regeneratively cooled thrust chamber liners. Test results indicated repeatable mechanical properties could be produced in copper deposits from the copper sulfate electrolyte with periodic current reversal and in nickel deposits from the sulfamate solution. Use of inert, removable channel fillers and the conductivizing of such is described. Techniques (verified by test) which produce high integrity bonds to copper and copper alloy liners are discussed. Author

N76-20482*# TRW, Inc., Jamestown, N.Y.
EFFECT OF BALL GEOMETRY ON ENDURANCE LIMIT IN BENDING OF DRILLED BALLS
Harold E. Munson 19 Dec. 1975 56 p refs
(Contract NAS3-17351)
(NASA-CR-134930) Avail: NTIS HC $4.50 CSCL 13I

Four designs of drilled (cylindrically hollow) balls were tested for resistance to bending fatigue. Bending fatigue has been demonstrated to be a limiting factor in previous evaluations of the drilled ball concept. A web reinforced drilled ball was most successful in resisting bending fatigue. Another design of through drilled design, involving a heavier wall than the standard reference ball, also showed significant improvement in resistance to bending fatigue. Author

N76-20483# Technische Hogeschool, Delft (Netherlands).
LIQUID-LUBRICATED SPIRAL-GROOVE BEARINGS Ph.D. Thesis
Jan Bootsma 19 Nov. 1975 196 p refs
Avail: NTIS HC $7.50

Spiral-groove bearings were studied in order to determine

the axial and radial load capacities by finding the pressure of the lubricating film. The differential equation of smoothed pressure was derived from the Reynolds equation, and the axial load capacities were considered for concentrically operating bearings. The theory of spiral-groove journal bearings, load capacity, functional losses, and stability are discussed. Experiments to prevent leakage of the lubricant in self-sealing spiral-groove journal bearings are described. F.O.S.

N76-20484*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACE-SEAL LUBRICATION. 2: THEORY OF RESPONSE TO ANGULAR MISALIGNEMENT
Lawrence P. Ludwig and Gordon P. Allen Washington Mar. 1976 26 p refs
(NASA-TN-D-8102; E-8410) Avail: NTIS HC $4.00 CSCL 11A

A theoretical analysis was made of a hypothetical seal operating mode. The hypothetical seal model provides for three degrees of primary ring motion and includes the force and moments induced by primary ring response to seat angular misalignment. This ring response causes a relative angular misalignment between the faces of the primary seal. Hydrodynamic pressure generation is produced by this misalignment. The analysis is based on the Reynolds equation in short bearing form and on a balance of forces and moments that arise from hydrodynamic and secondary seal friction effects. A closed form solution was obtained that can be solved for film thickness and relative angular misalignment. Author

N76-20485*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TREAD DRUM FOR ANIMALS Patent Application
Wayne H. Howard, inventor (to NASA) Filed 31 Mar. 1976 13 p
(NASA-Case-ARC-10917-1; US-Patent-Appl-SN-672223) Avail: NTIS HC $3.50 CSCL 13I

A tread drum is described for animals, such as primates. It includes a cylindrical housing mounted for rotation about a horizontal axis of revolution with a cylindrical treadway portion on which the animal treads while the drum is rotated by a motorized drive. The treadway portion of the drum includes an electrode structure with sectors independently energizable by a commutator and source of potential, so that an electrical shock station is created behind a running-in-place station on the moving treadway. In this manner, if the animal should fall behind its running-in-place station, it may be shocked by treading on the energized electrode structure. One end of the tread drum comprises a transparent wall for unobstructed viewing of the animal being exercised. NASA

N76-20486*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CLOSED LOOP SPRAY COOLING APPARATUS Patent Application
Donald L. Alger, William Schwab, and Edward R. Furman, inventors (to NASA) Filed 31 Mar. 1976 11 p
(NASA-Case-LEW-11981-1; US-Patent-Appl-SN-672220) Avail: NTIS HC $3.50 CSCL 13I

A closed loop apparatus for spraying coolant against the back of a radiation target is described. The coolant is circulated through a closed loop with a bubble of inert gas being maintained around the spray. Mesh material is disposed between the bubble and the surface of the liquid coolant which is below the bubble at a predetermined level. In a second embodiment no inert gas is used, the bubble consisting of vapor produced when the coolant is sprayed against the target. NASA

N76-20487*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COUNTER PUMPING DEBRIS EXCLUDER AND SEPARATOR Patent Application
Lawrence P. Ludwig, inventor (to NASA) Filed 31 Mar. 1976 13 p
(NASA-Case-LEW-11855-1; US-Patent-Appl-SN-672222) Avail: NTIS HC $3.50 CSCL 13I

A dirt separator and excluder is described for removing entrained debris from gas turbine shaft seals. A helical groove pattern is constructed on the rotating shaft with the pumping pattern such that it tends to pump seal pressurizing gas toward the gas turbine seal. A second helical groove pattern is provided on the stationary housing or counter rotating member coaxial with the shaft, and this pattern is designed to provide pumping in the direction opposite from that of the groove pattern on the shaft. Gas with entrained debris entering this grooved area is subjected to high centrifugal forces due to the swirl motion induced by the groove pattern and the rotation of the shaft. This debris is centrifuged outwardly into the outer groove pattern on the housing or counter rotating member. Since the outer groove pattern has a pumping direction opposite from that of the seal, dirt is pumped away from the seal and collected in a suitable debris trap. NASA

N76-20488*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL Patent Application
L. P. Ludwig, inventor (to NASA) Filed 31 Mar. 1976 9 p
(NASA-Case-LEW-12119-1; US-Patent-Appl-SN-672219) Avail: NTIS HC $3.50 CSCL 11A

A circumferential shaft seal comprising two sealing rings held to a rotating shaft by means of a surrounding elastomeric band is described. The rings are segmented and are of a rigid sealing material such as carbon or a polyimide and graphite fiber composite. NASA

N76-20489*# National Aeronautics and Space Administration, Washington, D.C.
HAND AND POWER TOOLS: A COMPILATION Technology Utilization
Jan. 1976 29 p ref
(NASA-SP-5976(06)) Avail: NTIS HC $1.00 CSCL 13I

Some hand and power tools were described. Section One describes several tools and shop techniques that may be useful in the home or commercial shop. Section Two contains descriptions of tools that are particularly applicable to industrial work, and in Section Three a number of metal working tools are presented. Author

N76-20490*# National Aeronautics and Space Administration, Washington, D.C.
MECHANICAL SYSTEMS: A COMPILATION Technology Utilization
Jul. 1975 30 p refs
(NASA-SP-5976(04)) Avail: NTIS HC $1.00 CSCL 13I

A compilation of several mechanized systems is presented. The articles are contained in three sections: robotics, industrial mechanical systems, including several on linear and rotary systems and lastly mechanical control systems, such as brakes and clutches. L.S.

N76-20491*# National Aeronautics and Space Administration, Washington, D.C.
FLUID HANDLING EQUIPMENT: A COMPILATION Technology Utilization
Jan. 1976 28 p
(NASA-SP-5976(03)) Avail: NTIS HC $1.00 CSCL 13I

Devices and techniques used in fluid-handling and vacuum systems are described. Section 1 presents several articles on fluid lines and tubing. Section 2 describes a number of components such as valves, filters, and regulators. The last section contains descriptions of a number of innovative fluid-handling systems. Author

N76-20492# United Kingdom Atomic Energy Authority, Culham (England).
REMOTELY OPERATED WELDING MACHINE
G. H. Rappe and B. C. Sanders Jan. 1975 18 p
(CLM-R-143) Avail: ERDA Depository Libraries HC $4.00; UK 50 pence

A remotely controlled welding machine used to automatically weld together segments of a large stainless steel torus is described. Author (NSA)

N76-20493# Sandia Labs., Albuquerque, N.Mex.
SOLID PHASE WELDING OF TRANSITION MEMBERS FOR RADIOISOTOPE THERMOELECTRIC GENERATORS

J. L. Jellison Sep. 1975 49 p refs
(Contract AT(29-1)-789)
(SAND-75-0053) Avail: NTIS HC $4.00

The feasibility is demonstrated of fabricating heat source-thermopile assemblies for radioisotope thermoelectric generators (RTG) by diffusion bonding techniques. The Au-Ni, Au-Cu, Au-Ag, and Au-Au systems were evaluated. With the 14 MN/sq m (2000 psi) and 823 K (550 C) limitations imposed on the bonding process so as not to damage the thermopile, bonds of acceptable strengths were only obtained with Au-Ni and Au-Cu systems. The Au-Ni system was selected for the transition members at the ends of the thermopile, because the Au-Cu system was not compatible for extended times at operating temperatures 673 K (approximately 400 C). Several solid-liquid interdiffusion (SLID) bonds were made using various combinations of gold or silver with germanium, indium, and tin-indium. Author (NSA)

N76-20494# Sandia Labs., Albuquerque, N.Mex.
ELECTROCHEMICAL JOINING: PROCESS APPLICATIONS, AND PROPERTY DATA
J. W. Dini and H. R. Johnson Aug. 1975 20 p refs Presented at the SME/ERDA Welding and Joining Workshop, Chicago, 28 Oct. 1975
(Contract AT(29-1)-789)
(SAND-75-8710; Conf-751012-4) Avail: NTIS HC $4.00

A procedure for joining various materials by using electroplating is described. Parts to be joined are first given a specific taper. Then they are cleaned, mated, and the triangular segment between the tapered edges is built up by electroplating, and the joint machined to final tolerance. Materials that have been electrojoined include aluminum, beryllium, copper, stainless steels, steels, titanium, and uranium and some of its alloys. Various tests such as tensile, compressive, heating, and corrosion have shown electrochemical joining to be a useful alternative to conventional processes. NSA

N76-20495# California Univ., Livermore. Lawrence Livermore Lab.
NARROW GROOVE GAS METAL-ARC WELDING OF ALUMINUM
R. E. Armstrong 21 Aug. 1975 12 p refs Presented at the SME/ERDA Welding and Joining Workshop, Chicago, 28 Oct. 1975 Sponsored by ERDA
(UCRL-77254; Conf-751012-3) Avail: NTIS HC $4.00

The Gas Metal-Arc (GMA) welding process is explained and the equipment used described with an analysis of power supply function and the action of the arc, followed by discussion of general applications and problems. GMA braze welding of beryllium is then described, as is the development of a special high purity filler wire and a narrow deep groove joint design for improved weld strength in beryllium. This joint design and the special wire are applied in making high strength welds in high strength aluminum for special applications. High speed motion pictures of the welding operation are shown to illustrate the talk. Author (NSA)

N76-20496# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRON BEAM WELDING FUNDAMENTALS AND APPLICATIONS
Glenn L. Mara and Robert E. Armstrong 21 Aug. 1975 10 p refs Presented at the SME/ERDA Advanced Welding and Joining Workshop, Chicago, 28-30 Oct. 1975 Sponsored by ERDA
(UCRL-77253; Conf-751012-2) Avail: NTIS HC $4.00

The electron beam welding process is described and the unique mode of operation and penetration explained by a description of the forces operating within the weld pool. This penetration model is demonstrated by high speed cinematography of the weld pool on several materials. The conditions under which weld defects are formed are discussed and examples are presented. NSA

N76-20497# Los Alamos Scientific Lab., N.Mex.
FUSION WELDING OF THIN METAL FOILS
Hugh Casey 1975 12 p ref Presented at the SME/ERDA Advanced Welding and Brazing Workshop, Chicago, 29-30 Oct. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1605; Conf-751017-4) Avail: NTIS HC $4.00

Aspects of fusion welding of thin metal foils are reviewed and the current techniques employed at LASL to join foils are described. Techniques for fusion welding approximately 0.025-mm-thick foils of copper, aluminum, and stainless steels were developed using both electron beam and laser welding equipment. These techniques, together with the related aspects of joint design, tooling and fixturing, joint preparation, and modifications to the commercially available welding equipment, are included. Author (NSA)

N76-20498# Los Alamos Scientific Lab., N.Mex.
ELECTRON-BEAM WELDING OF 21-6-9 (Cr-Ni-Mn) STAINLESS STEEL: EFFECT OF MACHINE PARAMETERS OF WELDABILITY
Hugh Casey Apr. 1975 13 p refs
(Contract W-7405-eng-36)
(LA-5970-MS) Avail: NTIS HC $4.00

The high-manganese, nitrogen-strengthened 21-6-9 (Cr-Ni-Mn) austenitic stainless steel has a weldability rating similar to that of more common austenitic stainless steels in terms of cracking, porosity, etc. However, weld pool disruption problems may occur with this alloy that can be related to instability within the molten weld pool. Selection of machine parameters is critical to achieving weld pool quiescence as this report confirms from recent tests. Test samples came from heats of air-melted, vacuum-arc remelted, and electroslag remelted material. Low- and high-voltage machine parameters are discussed, and effects of parameter variation on weld pool behavior are given. Data relate weld pool behavior to weld fusion-zone geometry. Various weld parameters are recommended for the 21-6-9 alloy, regardless of its source or chemistry. Author (NSA)

N76-20499# Oak Ridge National Lab., Tenn.
FLAW-SIZE MEASUREMENT IN A WELD SAMPLE BY ULTRASONIC FREQUENCY ANALYSIS
Laszlo Adler, K. V. Cook (Tenn. Univ., Knoxville), H. L. Whaley, Jr., and R. W. McClung (Babcock and Wilcox Co., Lynchburg, Va.) 1975 30 p refs Presented at the Conf. of Am. Soc. for Nondestructive Testing, Inc., Atlanta, 13 Oct. 1975 Sponsored by ERDA
(CONF-751016-1) Avail: NTIS HC $4.50

An ultrasonic frequency-analysis technique was developed and applied to characterize flaws in an 8-in. (203-mm) thick heavy-section steel weld specimen. The technique applies a multitransducer system. The spectrum of the received broad-band signal is frequency analyzed at two different receivers for each of the flaws. From the two spectra, the size and orientation of the flaw are determined by the use of an analytic model proposed earlier. Author (NSA)

N76-20500# Sandia Labs., Albuquerque, N.Mex.
PARALLEL GAP WELDING TO THICK FILM METALLIZATION
D. R. Johnson and R. E. Knutson Apr. 1975 41 p refs
(Contract AT(29-1)-789)
(SAND-74-0377) Avail: NTIS HC $5.25

The study was directed at the parallel gap welding response of a series of gold and platinum-gold thick film conductor materials that were subjected to variable peak temperature/belt speed firing profiles. These thick film materials, all fritted, included two pure golds (DuPont EX8760 and ESL 8831) and four platinum-golds (DuPont 8653, DuPont 8895, Cermalloy 4100, and Cermalloy 4120). Upon printing and drying according to each manufacturer's recommendations, the weld test patterns were fired at peak temperature of 800, 850, 900, or 950 C with belt speeds of 0.4, 0.6, or 0.8 millimeters per second. Parallel gap welding was conducted using a repeating series of weld voltage/pulse duration settings and a nominal 0.05 millimeter thick by 0.38 millimeter wide pure gold ribbon. Evaluation of the welds was determined through a 90 deg peel test. Conclusions are presented. Author (NSA)

N76-20501# Centre National d'Etudes Spatiales, Toulouse (France).
COMPOSITE SELF-LUBRICATING MATERIALS FOR SPACE APPLICATIONS [MATERIAUX COMPOSITES AUTOLUBRIFIANTS POUR UTILISATIONS SPATIALES]

Michel Roussel Sep. 1975 32 p refs In FRENCH; ENGLISH summary
(CNES-NT-25) Avail: NTIS HC $4.00

Experimental devices and results which have allowed polyimide resin with fillers as self-lubricating composites to be selected are discussed. These materials were prepared in order to manufacture ball bearing cages working in ultra high vacuum. Wear in air and in vacuum and coefficient of friction in air are given for the best materials. Other essential characteristics have been measured: vacuum stability, porosity, hardness, etc. These materials could be used in space mechanisms working at high rates and high temperatures. Author (ESA)

N76-20502# Hitchiner Mfg. Co., Inc., Milford, N.H.
MACHINE CASTING OF FERROUS ALLOYS Interim Report, Feb. - Jun. 1975
G. D. Chandley and Gary Scholl Sep. 1975 31 p refs
(Contract DAAG46-73-C-0112; ARPA Order 2267)
(AD-A016971; AMMRC-CTR-75-18) Avail: NTIS CSCL 13/8

Due to the lack of economic permanent die materials for use in Hipocasting ferrous alloys, three innovative approaches for creating a mold cavity for use in machine casting of ferrous alloys were explored. They were: use of liquid metal cooling of a thin walled die, use of a porous die, vacuum coated with dry ceramic and use of a membrane to vacuum from a disposable mold. Vacuum forming a disposable mold appears to be the most promising method for machine casting of ferrous alloys. GRA

N76-20503# Aerospace Corp., El Segundo, Calif.
MIGRATION OF APIEZON C ON METAL SUBSTRATES UNDER THE INFLUENCE OF TEMPERATURE GRADIENTS Interim Report
Alfred A. Fote, Leon M. Dormant, and Seymour Feuerstein 15 Oct. 1975 23 p refs
(Contract F04701-75-C-0076)
(AD-A017476; TR-0076(6892)-1; SAMSO-TR-75-208) Avail: NTIS CSCL 11/8

An investigation of the surface migration of thin films of Apiezon C on metal substrates was undertaken. The study was initiated in order to determine the effect of temperature gradients on the distribution of lubricants in spacecraft mechanical assemblies. It was discovered that temperature gradients of 0.5C/cm led to almost complete oil-film migration toward the colder end after three days. A larger gradient of 2.0C/cm led to an approximately equivalent transfer after one day. GRA

N76-20504# Lehigh Univ., Bethlehem, Pa. Dept. of Metallurgy and Materials Science.
AN UPPER-BOUND ANALYSIS OF THE UPSET FORGING OF RECTANGULAR STRIP AND SOLID CYLINDRICAL DISC TO ACCOUNT FOR BULGE AND FOLD Final Report
Ronald A. Kohser Apr. 1975 188 p refs
(Grant NSF GK-37536)
(PB-245973/3; NSF/GK-37536-2) Avail: NTIS HC $7.50 CSCL 13H

With the assumption of a Mises perfectly plastic material and constant shear stress friction, the upper-bound analysis technique was applied to the upset forging of rectangular strip and solid cylindrical discs in an effort to incorporate the combined phenomena of bulge and fold. A two-zone two-parameter solution was developed for the strip geometry and successfully produced a lower upper-bound for conditions of high interface friction. A more general three-parameter solution was developed, but was abandoned when investigation showed the increase in complexity failed to yield any additional benefit. For the disc geometry, a parallel solution was then developed. While failing to produce a lower upper-bound, the new solution comes sufficiently close to previous solutions to merit further refinement and additional investigation. Both the strip and disc solutions were then applied in an incremental technique designed to model deformation with bulge and fold. The results appear most encouraging, and the relative simplicity of the technique, when compared with present alternatives, is quite attractive. GRA

N76-20505# Transportation Systems Center, Cambridge, Mass.
AUTOMOTIVE ENERGY EFFICIENCY PROGRAM
Harold G. Miller Jun. 1975 273 p refs Presented at the Contractors Coordination Meeting, 15-17 Jan. 1975
(PB-245808/1; DOT-TSC-OST-75-31) Avail: NTIS HC $9.00 CSCL 13F

The capability of the automotive industry to significantly improve the fuel economy of production vehicles is assessed along with the related socio-economic effects. The primary objective of the conference was to report on progress to date and future plans of the Automotive Energy Efficiency Program and to promote the exhange of information between government, industry and university investigators. Papers and illustrated lectures presented at the conference are included. GRA

N76-20506# Cornell Univ., Ithaca, N.Y. Coll. of Engineering.
COMPUTER-AIDED INJECTION MOLDING SYSTEM Progress Report, 1 Jul. - 31 Dec. 1974
K. K. Wang, S. F. Shen, J. F. Stevenson, C. A. Hieber, and S. Chung Jan. 1975 82 p refs
(Grant NSF ATA-74-11490)
(PB-246110/1; NSF/RA/T-75-003) Avail: NTIS HC $5.00 CSCL 11I

The injection molding technology is analyzed by treating the problem as an integrated system of mold design, mold making and process control. The CAD/CAM system concept is applied to rhe design and manufacture of molds by bringing to bear basic knowledge of fluid mechanics, heat transfer, rheology, and computer technology to develop a computer based system which will define the mold geometry, analyze the flow and solidification of the polymer melt, predict optimal process variables and ultimately generate an N/C tape for mold manufacture. The current effort on identification of problem areas is discussed in terms of flow analysis and the rheological properties of material. Exploratory investigations based on one-dimensional radial and channel flow include the effects of the thermal boundary condition, pressure-dependence of viscosity and the normal stress difference on flow. GRA

N76-20507# Arizona Univ., Tucson. Dept. of Chemical Engineering.
OFF LINE DEVELOPMENT AND TESTING OF A MINICOMPUTER PROCESS CONTROL PROGRAM FOR AN INDUSTRIAL GRINDING CIRCUIT
T. W. Peterson, J. W. White, and E. E. Krist (ANAMAX Mining Co.) Nov. 1973 34 p refs Presented at the 103d Ann. Meeting of AIME, Dallas, Tex., Feb. 1974
(Grant NSF GI-38067)
(PB-245639/0; COM-73-12; NSF/RA/T-73-070) Avail: NTIS HC $4.00 CSCL 13H

A dynamic simulation for testing a minicomputer controlled industrial rod and ball grinding circuit is described. Provision is made for debugging and testing the software separate from the actual hardware of the grinding circuit. A mathematical model for the entire process system and a communication simulation package for connection to the system is described. The arrangement described allows individual testing of the various components of the system allowing a saving of time. The report outlines the steps in the system development and testing and the results obtained. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-20508*# National Aeronautics and Space Administration, Washington, D.C.
MANUFACTURING DESIGN AND QUALITY CONTROL: A COMPILATION Technology Utilization
Jan. 1976 29 p ref
(NASA-SP-5977(03)) Avail: NTIS HC $1.00 CSCL 14D

Testing equipment and quality control procedures are described. Articles that are helpful in the evaluation, analysis, and selection of materials are presented along with patent information. Author

N76-20509*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
STRAINRANGE PARTITIONING BEHAVIOR OF AN AUTOMOTIVE TURBINE ALLOY Final Report, 13 Dec. 1974 - 13 Dec. 1975
C. G. Annis, M. C. VanWanderham, and R. M. Wallace Feb. 1976 80 p
(Contract NAS3-18930)
(NASA-CR-134974; FR-7424) Avail: NTIS HC $5.00 CSCL 14D

This report addresses Strainrange Partitioning, an advanced life prediction analysis procedure, as applied to CA-101 (cast IN 792 + Hf), an alloy proposed for turbine disks in automotive gas turbine engines. The methodology was successful in predicting specimen life under thermal-mechanical cycling, to within a factor of + or - 2. Author

N76-20510# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE RELATIONSHIP OF THE QUALITY OF DELIVERED PRODUCTS TO DEPARTMENT OF DEFENSE PROCUREMENT POLICIES AND PROCEDURES M.S. Thesis
Lawrence M. Kruse and Dmitri Taras Aug. 1975 98 p refs
(AD-A016023; SLSR-20-75B) Avail: NTIS CSCL 15/5

The relationship of the quality levels of delivered products to Department of Defense procurement policies and procedures was explored by Chi-square and multiple regression statistical tests on a quality audit program sample of San Antonio Air Logistics Center spare parts contracts. The procurement process variables studied were priority of requirement, complexity of item, contrast specifications, type of inspection clause, type of solicitation, market environment, size of contractor, type of contractor quality capability evaluation, type of contract price agreement, type of contractual instrument, contract modifications, contract administration activity, and contract administration activity quality assurance functions. GRA

N76-20511# IBM Watson Research Center, Yorktown Heights, N.Y.
THE PHYSICS OF RELIABILITY OF FUTURE ELECTRONIC DEVICES Semiannual Technical Report
Thomas H. DiStefano and King-Ning Tu L. G. Hanscom Field, Mass. AFCRL 30 Nov. 1975 122 p refs
(Contract F19628-74-C-0077)
(AD-A016965; AFCRL-TR-75-0412; SATR-2) Avail: NTIS CSCL 20/12

The following investigations are discussed in the report: (1) At several metal-SiO2 interfaces, it was found that interdiffusion of the metal into the insulator induces a dipole layer which comprises a significant portion of the surface potential. The significance of this finding is that surface effect devices (MOS,CCD), which depend upon a stable surface potential, may be sensitive to changes in the dipole layer produced by time, temperature, electric fields, and impurities; (2) Transport measurements were performed on Si3N4 films deposited on Si. The valence band structure of Si3N4 and amorphous SiO2 has been examined by X-ray photoemission spectroscopy; (3) Near-noble metals react with Si single crystals to form a metal-rich silicide at 100C to 200C. The low temperature reaction is explained by proposing an interstitial model; (4) A review on the nature of thin film interfacial reactions with examples from the field of integrated circuits is given. The study of the reactions can be facilitated by a combination of three analytical tools--depth profiting by nuclear backscattering, surface analytical techniques combined with layer removal by sputtering and glancing angle X-ray diffraction. GRA

N76-20512# National Bureau of Standards, Washington, D.C. Product Systems Section.
A STUDY OF THE FEASIBILITY OF ESTABLISHING GENERIC ENVIRONMENTAL TEST PARAMETERS FOR ALL CONSUMER PRODUCTS Final Report
Samuel D. Toner Mar. 1975 10 p Sponsored in part by Consumer Product Safety Commission
(COM-75-11434/8; NBSIR-74-590) Avail: NTIS HC $3.50 CSCL 05A

The feasibility is studied of establishing a set of generic environmental test parameters that would be applicable to all types of consumer products, with a potential for developing injury producing hazards as a result of environmentally induced failure. It was concluded that this approach is not a practical one. It is apparent that the safeness of a product or type of product should be determined on the basis of simulated environmental tests appropriate to its specific end use. GRA

N76-20513# Mitsubishi Heavy-Industries Ltd., Tokyo (Japan).
A REAL TIME CONVERSATIONAL ON-LINE PROCESSING SYSTEM FOR FACTORY TESTS OF COMPRESSORS AND DRIVING TURBINES
Tsutome Naritomi, Itsuo Murata, Aoko Kuwabara, and Shigehiro Hurukawa Sep. 1975 12 p
(PB-246498/0; MTB-102) Avail: NTIS HC $3.50 CSCL 13H

A real time conversational system, employing a mini-computer and C/D (Character Display), capable of measuring and calculating quickly and accurately for compressors and driving turbines, has been established. Its principal features include the following: (1) the compressor types and test patterns are standardized and programmed; (2) the flow of the test pattern and the selection of test items are indicated on the C/D, and the operator is just to follow this indication; (3) a table for physical properties and calibrated values of the detector is filed on magnetic disk for use by the on-line system; (4) its use is able to save eight persons for measurement and one week for calculation; and (5) a new display programming language was developed to facilitate the C/D. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N76-20514 Illinois Univ., Urbana.
OPTIMIZATION OF STRUCTURES BY METHOD OF CENTERS Ph.D. Thesis
Chung-Yi Chiou 1975 133 p
Avail: Univ. Microfilms Order No. 76-6721

The application of the method of centers to structural design optimization problems is investigated. The structures studied include trusses, continuous beams, and rigid frames. The objective function which is the weight of the structure is linear. The constraints which limit the stresses and provide for safety against buckling in accordance with the AISC manual, are nonlinear inequalities. The solution process starts with an arbitrarily selected point and the corresponding contour of the objective function. The center and its F-distance value for the assumed contour are then determined by an iterative scheme. At each iteration, the nonlinear constraint functions are linearized by taking the first term of the Taylor series at that point. The resulting linear programming problem is solved by simplex algorithm. The solution yields a usable direction along which the step length is determined by maximizing the F-distance in one variable. If the F-distance at center for assumed weight is zero, the solution of the problem is reached. Dissert. Abstr.

N76-20515 Cincinnati Univ., Ohio.
MINIMUM WEIGHT DESIGN OF AXIALLY COMPRESSED UNSTIFFENED AND STIFFENED COMPOSITE CYLINDERS Ph.D. Thesis
Banarsi Lal Agarwal 1975 127 p
Avail: Univ. Microfilms Order No. 76-1

Optimum designs for axially compressed unstiffened, stiffened and honeycomb sandwich cylinders are determined using a structural synthesis technique. Effects of using a smeared stiffener buckling analysis for the optimization program are investigated through the use of a more accurate branched shell buckling analysis of a computer code BUCLASP-2. Ignoring the effects of laminated wall construction in calculating the bending stiffness matrix for unstiffened cylinder can result in as much as 20% error in the calculation of buckling load. The stiffener cross-sectional deformations which are ignored in smeared stiffener theory result in about 30-percent lower buckling load for

graphite-epoxy-hat stiffened cylinder, as compared with branched shell theory. These stiffener deformations are approximately taken into account in smeared stiffener theory. Optimization results for graphite-epoxy cylinders show about 50 percent weight savings over optimized aluminum cylinders over wide loading range.
Dissert. Abstr.

N76-20516 Ernst-Mach-Inst., Freiburg (West Germany).
TESTS OF CONCRETE PLATES TO DETERMINE FAILURE CHARACTERISTICS
R. Geppert 1975 44 p refs In GERMAN
(Rept-1/75) Avail: Issuing Activity

A total of 19 selected reinforced steel/concrete plates were subjected to blast loads. Six plates were loaded statically: the separate load-deformation curves show good agreement. Seven plates were investigated near-statically: fracturing occurred after a blast loading of 2.1 bar. Six plates were subjected to pulsed blasts (ballistically): fracturing occurred at a top overpressure of 3.2 bar and an impulse of 37 msec/bar. A shorter pressure decay time than 21 msec could not be obtained for constructional reasons so that weapon simulation has a lower limit. ESA

N76-20517# Polytechnic Inst. of New York, Brooklyn. Dept. of Aerospace Engineering and Applied Mechanics.
VIBRATIONS OF A STIFFENED CAPPED CYLINDER
J. M. Klosner, M. L. Pollack, and Y. N. Chen 22 Oct. 1975 31 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jul. 1976
(Contract N00014-67-A-0438-0006)
Avail: NTIS HC $4.00

The natural frequencies and modes were obtained for stiffened and unstiffened cylindrical shells having spherical end caps. Comparisons of these are made with those obtained for an unreinforced cylindrical shell having various edge conditions. The results indicate that at the higher circumferential wave numbers, the frequencies of the unreinforced shells are independent of the end conditions. Results for the ring-stiffened capped shell indicate that above a critical circumferential wave number the stiffeners raise the value of the frequencies, while below that number they reduce their values. Author

N76-20518*# Scientific Translation Service, Santa Barbara, Calif.
WIND PRESSURE ON TOWER MEMBERS
Y. Shichiri Washington NASA Mar. 1976 31 p refs Transl. into ENGLISH from J. Inst. Elec. Eng. (Japan), v. 58, May 1938 p 207-216
(Contract NASw-2791)
(NASA-TT-F-16874) Avail: NTIS HC $4.00 CSCL 13M

The effects of wind pressure on a whole tower are investigated as a function of air resistance coefficients. Air resistances for steel members of infinite length and for steel members of finite length were measured using the wind tunnel method. Author

N76-20519*# Scientific Translation Service, Santa Barbara, Calif.
WIND PRESSURE ON TOWERS CONSTRUCTED WITH PIPE STEEL
Y. Shichiri Washington NASA Mar. 1976 15 p refs Transl. into ENGLISH from J. Inst. Elec. Eng. (Japan), v. 82, No. 883, Apr. 1962 p 554-558
(Contract NASw-2791)
(NASA-TT-F-16965) Avail: NTIS HC $3.50 CSCL 20M

A description is given of wind tunnel experiments on angle steel towers. Experimental conditions are discussed, and it is concluded that when steel towers receive the wind obliquely, the wind pressure load is less for pipe steel than for angle steel. Author

N76-20520# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
ISD LECTURES ON NUMERICAL METHODS IN LINEAR AND NONLINEAR MECHANICS
Sep. 1974 439 p refs Presented at a Conf. at Jablonna, Poland, 22-28 Sep. 1974; sponsored by Polish Acad. of Sci. Sponsored in part by Deut. Forschungsgemeinschaft
Avail: NTIS HC $11.75

The application of the finite element method to static and dynamic structural analysis is discussed. An introduction is given to the complete linear finite element technique with special regard to the natural formulation. Several procedures are described to find the dynamic response of a modally damped linear elastic system. The finite element displacement method is expanded to include the effects of geometry variation resulting from displacements. The step by step integration of nonlinear equations of motion is described. Two alternative methods currently used for the elastoplastic finite element analysis of continua are discussed. Recent finite element developments in limit load analysis of thickwalled concrete structures are outlined. For individual titles, see N76-20521 through N76-20526.

N76-20521 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
FINITE ELEMENTS IN LINEAR STATICS AND DYNAMICS: THE NATURAL APPROACH
J. H. Argyris, H. P. Mlejnek, J. Buehlmeier, and M. M. Mai *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 87 p refs (For availability see N76-20520 11-39)

An introduction to the complete linear finite element technique is presented. The basic equations of the theory of elasticity are rewritten in matrix notation and the necessary energy principles are derived. Considerations are concentrated on the displacement approach. Similarities and differences between the finite element method and the traditional Rayligh-Ritz process are explained. All basic equations for the generation of a linear system in displacement unknowns are formulated. The realization of elements both of the simpler and sophisticated curved types is discussed. The introduction of boundary conditions, aspects of the solution process, and the implementation of structural modifications are dealt with. Some remarks are made about possible numerical errors in the analysis. Author (ESA)

N76-20522 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
COMPUTER ORIENTED LINEAR DYNAMIC ANALYSIS
J. H. Argyris, K. A. Braun, G. Dietrich, and K. Straub *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 82 p refs (For availability see N76-20520 11-39)

Based on the finite element method, several procedures to find the dynamic response of a modally damped linear elastic system, which were already programmed and used for the solution of large scale technical problems, are described. The response to external excitation was calculated as linear combination of certain eigenmodes of the structure. For the special case of modal damping, the general linear elastic dynamic equation was reduced to a system of first order differential equations. The solution of the homogeneous problem was found by solving the eigenvalue problem. Three methods are discussed: simultaneous vector iteration with Chebyshev acceleration and the capability of tackling problems with rigidbody modes; Householder-Givens method followed by inverse iteration with shift; and the Jacobi method for small problems for finding all eigenvalues and eigenvectors. All three methods are adapted to the hypermatrix concept allowing the solution of large scale problems and an efficient usage of a computer with back up storage. A coordinate transformation with a certain number of eigenvectors delivers to a decoupled system of linear differential equations of first order. Depending on the excitation R a numerical or analytical integration procedure is chosen. Author (ESA)

N76-20523 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
GEOMETRIC NONLINEARITY AND THE FINITE ELEMENT DISPLACEMENT METHOD
J. H. Argyris, M. Koenig, D. A. Nagy, M. Haase, and G. Malejannakis *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 85 p refs (For availability see N76-20520 11-39)

The finite element displacement method is expanded to include the effect of geometry change, resulting from displacements, upon the equilibrium of the forces and stresses causing the displacements. The limited cases are considered in which these geometrically nonlinear effects first appear at a certain critical load level in the form of an alternate equilibrium configuration. Such problems of linear bifurcation buckling are formulated by combining potential energy considerations, nonlinear strain-

displacement relations, and the usual displacement interpolation of the finite element method. The resulting matrix eigenvalue problem is solved using the simultaneous vector iteration procedure. The verification of initial assumptions and the implications of substructuring and condensation are discussed. Computational examples of frame, plate, and shell buckling are presented to show the accuracy and effectiveness of the methods. The more general and complicated cases where the deformations are nonlinear functions of the applied loading due to the significant geometry changes are considered. Large strains and material nonlinearity are excluded. Expansion of the natural mode technique is presented because it provides a clear insight into the physical nature of the nonlinearity. The derivation of the natural mode technique for large displacements is presented in general form and illustrated via application of the general equations to the case of the simple flange element. Methods of solution for the resulting incremental load - incremental displacement linear algebraic equations are discussed. Computational examples are presented to demonstrate the utility of the methods.

Author (ESA)

N76-20524 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

NONLINEAR DYNAMICS: PROBLEMS OF LARGE DEFORMATIONS

J. H. Argyris, P. C. Dunne, T. Angelopoulos, and B. Bichat *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 58 p refs (For availability see N76-20520 11-39)

Some recent work on the step by step integration of nonlinear equations of motion is described. The methods developed are capable of dealing with structures of over 2000 degrees of freedom. The structure is represented by a finite element idealization. The basis of the method is in the Hermitian cubic interpolation of the inertia faces which allows a much higher precision for a given integration time step than, for example, the well known Newmark method and its variants. The algorithm is developed in two forms the first of which involves incremental linearization. The second form uses a direct iterative solution of the nonlinear equations. The linearization techniques make use of a stiffness matrix which is the average of the tangent stiffness at the beginning and end of a time step. Since it is possible with this stiffness matrix to accumulate the elastic force increments to evaluate the current nodal forces, the method is very rapid in the smaller systems where the stiffness matrix may be manipulated in core. In large structures the stiffness matrix exceeds the core capacity (64 K core) and the direct iterative solution in which the nodal forces are calculated element-wise is more efficient. A number of simple examples are given. The power of the method when applied to a large tension roof with 1,164 freedoms is described. Author (ESA)

N76-20525 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

MATERIAL NON-LINEARITIES IN THE FINITE ELEMENT ANALYSIS

J. H. Argyris, H. Balmer, and J. S. Doltsinis *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 55 p refs (For availability see N76-20520 11-39)

Two alternative general methods currently in use for the elastoplastic finite element analysis of continua are discussed: the tangential stiffness method and the initial load method. The latter can be formulated either in terms of initial strains or in terms of initial stresses. It is shown that each method follows in a natural way from the manner in which the elastoplastic material behavior is described. Thereby the essential difference between the initial strain and initial stress approach becomes apparent. The fundamental incremental elastoplastic stress-strain relations are derived in a form suitable for numerical treatment. They are based on the well established von Mises yield condition and its associated flow rule. Isotropic as well as kinematic hardening are taken into account. Special care has been taken to deal correctly with the important plane stress/strain case. Also described is the incorporation of creep effects and temperature effects due to thermal expansion or temperature dependent material properties. After having established the governing relations for the continuum, they are brought into connection with the actual finite element technique. Several examples of practical interest should indicate the range of applicability of the method presented. They include an experimental comparison of a perforated plate, the heat shrinking of a railway wheel, a long cylindrical shell under cyclic loading, and the creep behavior of a pressure vessel. Author (ESA)

N76-20526 Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

FINITE ELEMENT ULTIMATE LOAD ANALYSIS OF THREE-DIMENSIONAL CONCRETE STRUCTURES

J. H. Argyris, G. Faust, J. Szimmat, E. P. Warnke, and K. J. Willam *In its* ISD Lectures on Numerical Methods in Linear and Nonlinear Mech. Sep. 1974 69 p refs Sponsored by Bundesmin. fuer Forsch. u. Technol. (For availability see N76-20520 11-39)

Recent finite element developments in limit load analysis of thick-walled concrete structures are described. Several second order finite elements are introduced for the geometric idealization of three-dimensional composite structures made of reinforced and prestressed concrete. Two models are presented for predicting failure of concrete type materials under triaxial conditions. A three parameter extension of Mohr-Coulomb and a five parameter elliptic paraboloid are incorporated in two incremental laws which describe the material response in failure and post-failure regimes. One constitutive relation is developed along the engineering theory of fracture for granular solids, the other is based on the theory of elastoplasticity with a non-associated flow rule and softening in tension. The numerical solution of the ensuing nonlinear problem is discussed in the light of limit load analysis of complex three-dimensional structures. These aspects are illustrated with three ultimate load analysis examples: a thick-walled concrete cylinder, a 1 : 5 scale prestressed concrete reactor model, and a 1 : 11 scale reactor top-closure model made of lined concrete. Author (ESA)

N76-20527# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.

CALCULATION OF PRESTRESSED CONCRETE REACTOR PRESSURE VESSELS [ZUR BERECHNUNG VON SPANNBETON-REAKTORDRUCKBEHAELTERN]

1975 106 p refs In GERMAN Proc. of Spannbeton-Reaktordruckbehaelter Symp., Berlin, 13-14 Oct. 1975 (ISD-178) HC $5.50

The structural analysis of prestressed concrete nuclear reactor pressure vessels using finite elements is discussed. A computer program, SMART, is described for pressure vessel design calculation. A summary is given of the direct and incremental calculation method for the long term behavior of concrete creep. The limit load behavior was analyzed, and a program is described for calculating temperature and moisture fields in thick-walled concrete structures. For individual titles, see N76-20528 through N76-20531.

N76-20528 Stuttgart Univ. (West Germany).

SMART: STRUCTURE MECHANICAL ANALYSIS IN REACTOR TECHNOLOGY [SMART - STRUKTURMECHANISCHE ANALYSE IN DER REAKTORTECHNOLOGIE]

J. H. Argyris, G. Faust, J. Szimmat, E. P. Warnke, and K. J. Willam *In its* Calculation of Prestressed Concrete Reactor Pressure Vessels 1975 40 p refs In GERMAN (For availability see N76-20527 11-39)

A program system, SMART, is presented for calculating prestressed concrete reactor pressure vessels with finite elements. The specification of SMART is described, and a short representation is given of the analytic possibilities and the extensions for investigations of creep, limit load behavior and thermal diffusion. Examples are given of SMART application. ESA

N76-20529 Stuttgart Univ. (West Germany).

LONG TERM ANALYSIS WITH FINITE ELEMENTS [ZUR LANGZEITANALYSE MIT FINITEN ELEMENTEN]

J. H. Argyris, J. Szimmat, and K. J. Willam *In its* Calculation of Prestressed Concrete Reactor Pressure Vessels 1975 25 p refs In GERMAN (For availability see N76-20527 11-39)

The direct and incremental calculation method for the long term behavior of concrete creep using finite elements is summarized briefly. A survey is given of the method of internal state variables, which produces a unified framework for the various

formulations of concrete creep, and also a computerizable algorithm. Two examples of the long term method illustrate the usefulness of the algorithm. ESA

N76-20530 Stuttgart Univ. (West Germany).
LIMIT LOAD ANALYSIS WITH FINITE ELEMENTS [ZUR GRENZLASTANALYSE MIT FINITEN ELEMENTEN]
J. H. Argyris, G. Faust, and K. J. Willam *In its* Calculation of Prestressed Concrete Reactor Pressure Vessels 1975 22 p refs In GERMAN (For availability see N76-20527 11-39)

The limit load behavior of prestressed concrete reactor pressure vessels was investigated from the point of view of structural mechanics and of the failure of heterogeneous thick-walled concrete supporting structures. A material model was formulated for triaxial concrete strength, and finite elements were used to determine the load carrying capability. The engineering model based on plasticity theory, was developed from an expanded Mohr-Coulomb representation, having an ideal plastic behavior and describing a strength decline resulting from tensile and shear fracture. The related stress rearrangements can be represented by constitutive ancillary conditions of an elastic system, which are converted numerically to the form of initial load iteration. Examples of limit load analysis are given for a thick-walled hollow cylinder and a top cover model of a reactor pressure vessel. ESA

N76-20531 Stuttgart Univ. (West Germany).
CALCULATION OF TEMPERATURE AND MOISTURE FIELDS WITH FINITE ELEMENTS [ZUR BERECHNUNG VON TEMPERATUR- UND FEUCHTEFELDERN MIT FINITEN ELEMENTEN]
J. H. Argyris, E. P. Warnke, and K. J. Willam *In its* Calculation of Prestressed Concrete Reactor Pressure Vessels 1975 17 p refs In GERMAN (For availability see N76-20527 11-39)

Analytic possibilities and applications are described for SMART 2, a software package for determination of temperature and moisture fields in thick-walled support structures, related to the thermal diffusion in concrete reactor vessels. Thermal diffusion, i.e. interaction of temperature and moisture transport was investigated; solutions are given for nonlinear and unsteady behavior. ESA

N76-20532# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
USE OF DIGITAL COMPUTERS FOR PROBLEMS IN STRUCTURAL FATIGUE RESEARCH
O. Buxbaum, ed. and E. Haibach, ed. Dec. 1974 56 p refs In GERMAN; ENGLISH summary
(LBF-TB-117/74) Avail: NTIS HC $4.50

Structural stress-time functions originating from vibration effects, and their mathematical treatment using existing models, are discussed. An example is given for the analysis of road surface effects on automobiles. The generation of stationary Gaussian random processes using a noise generator, or a digital computer is discussed with regard to simulating vibratory loads for fatigue tests. The computerization of the stepping and superposition of stress collectives is reported in relation to fatigue life calculations using cumulative damage hypotheses. An example is given for a mineral oil pipeline. For individual titles, see N76-20533 through N76-20535.

N76-20533 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
DESCRIPTION OF THE STRESSES OF STRUCTURES FOR SEVERAL SIMULTANEOUSLY ACTING TIME VARIABLE LOADS [ZUR BESCHREIBUNG DER BEANSPRUCHUNGEN AN KONSTRUKTIONEN BEI MEHREREN GLEICHZEITIG WIRKENDEN, ZEITLICH VERAENDERLICHEN KRAEFTEN]
O. Buxbaum and J. M. Zaschel *In its* Use of Digital Computers for Probl. in Struct. Fatigue Res. Dec. 1974 p 7-23 refs In GERMAN (For availability see N76-20532 11-39)

Structural stress-time functions originating from vibration effects and their mathematical treatment using existing models are discussed. The time relation between external loads and local elongations is established in matrix form. The transfer function of the structure is described by using harmonic analysis. An example is given of a stress-time analysis for an automobile traveling along a road. ESA

N76-20534 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
GENERATION OF STATIONARY GAUSSIAN RANDOM PROCESSES WITH SPECIFIED CHARACTERISTIC VALUES [GENERIERUNG VON STATIONAEREN GAUSSCHEN ZUFALLSPROZESSEN MIT VORGEGEBENEN STATISTISCHEN KENNWERTEN]
R. Fischer *In its* Use of Digital Computers for Probl. in Struct. Fatigue Res. Dec. 1974 p 25-43 refs In GERMAN (For availability see N76-20532 11-39)

The simulation of structural loads resulting from stochastic vibration processes, such as gusts, and engine vibrations for fatigue tests is considered. As a result of mathematical regularities, stationary Gaussian processes can be produced by two different configurations: using a noise generator with bandpass filter and using a digital computer. The implementation of these solutions is outlined. ESA

N76-20535 Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE USE OF DIGITAL COMPUTERS FOR STEPPING AND SUPERPOSITION OF STRESS COLLECTIVES [DER EINSATZ VON DIGITALRECHNERN ZUR TREPPUNG UND UEBERLAGERUNG VON BEANSPRUCHUNGSKOLLEKTIVEN]
R. Olivier *In its* Use of Digital Computers for Probl. in Struct. Fatigue Res. Dec. 1974 p 45-55 refs In GERMAN (For availability see N76-20532 11-39)

The computerization of the stepping and superposition of stress collectives was investigated in relation to fatigue life calculations using cumulative damage hypotheses. Preparation of the stress collectives for digital computers is discussed. The basic principle of the computer programs is explained. Stress collectives, determined from a few characteristic values, can be used as stepped input into a partial program for cumulative damage calculations. A special program version allows partial collectives from mineral oil pipelines to be superposed with a total collective and to step this total collective. ESA

N76-20536# California Univ., Livermore. Lawrence Livermore Lab.
THREE-DIMENSIONAL STRESS DISTRIBUTION OF A DOUBLE-CANTILEVER BEAM WITH A SIDE NOTCH
W. F. Kirkwood and M. E. Prado 8 Aug. 1975 23 p refs Presented at 9th Natl. Symp. on Fracture Mechanics, Pittsburgh, 25 Aug. 1975 Sponsored by ERDA
(UCRL-77116; Conf-750836-1) Avail: NTIS HC $4.25

The effect of a side notch used as a crack guide in a double-centilever-beam specimen is investigated. The resulting stress distribution along the section of symmetry ahead of the notch is obtained from a three-dimensional photoelastic model. The effect of this side notch, through the thickness and down the side of the specimen is determined. After stress freezing, the model was sliced along principal planes. Along the x-x plane of symmetry, the principal stresses were determined by graphical integration of Filon's transformation of the Lame'-Maxwell equations and by subslicing along the x-z plane. Results of the investigation are in good agreement with those of other investigators. The side notch increases the value of the maximum tensile stress at the intersection of the starter notch and the side notch by approximately 22 percent. Author (NSA)

N76-20537# Explosives Research and Development Establishment, Waltham Abbey (England).
THE IMPACT STRENGTH OF POLYMERS. PART 2: GLASS FILLED THERMOPLASTICS
W. J. Pullen Nov. 1974 14 p ref
(ERDE-TN-139-Pt-2; BR49436) Avail: NTIS HC $3.50

The Charpy impact strength of nine glass filled thermoplastics was measured over the temperature range -50 to +80 C. Energy to fracture/temperature profiles were produced showing the effects of temperature and change in notch geometry.
Author (ESA)

N76-20538# Explosives Research and Development Establishment, Waltham Abbey (England).
TENSILE CREEP MEASUREMENT FOR PLASTICS DESIGN DATA
B. V. Howes Jun. 1974 30 p refs

(ERDE-TR-170; BR48834) Avail: NTIS HC $4.00

The need for the measurement of creep characteristics of engineering polymers is discussed and the most important considerations of creep characterization are presented. The development of specific creep equipment and light-weight extensometry is described. The development and operation of creep testing equipment are described and the means by which the results may be most suitably presented are discussed in detail. Examples of the creep curves and isochronous stress-strain curves obtained for two forms of glass filled polystyrene are given. Author (ESA)

N76-20539# California Univ., Berkeley. Div. of Structural Engineering and Structural Mechanics.

CRUVBRG: A COMPUTER PROGRAM FOR ANALYSIS OF CURVED OPEN GIRDER BRIDGES Final Report

D. P. Mondkar and G. H. Powell Dec. 1974 171 p refs Sponsored by DOT and Calif. State Business and Transportation Agency

(PB-245603/6; UCSESM-74-17) Avail: NTIS HC $6.75 CSCL 13M

A computer program for the structural and stress analysis of open girder (I-section) bridge superstructures is described. The bridge may be of essentially arbitrary shape in plan, and the girders may be of variable cross section along their length. Diaphragms and crossframes may be taken into account, and changes in form of the structure as its construction progresses may be considered. Deflections, stress resultants and stresses for static loads, support settlement effects and moving live loads are determined. Comparisons are made between computed behavior and that observed in model tests. GRA

N76-20540# Transportation Research Board, Washington, D.C.

ASPHALT PROPERTIES AND PERFORMANCE

Prithvi S. Kandhal 1975 72 p refs

(PB-246075/6; TRB/TRR-544; ISBN-0-309-02399-8) Avail: NTIS HC $4.50 CSCL 13C

Papers dealing with the physical properties and performance of asphalt cements are presented. Topics covered include: properties of recovered asphalts; asphalt binder hardening; low temperature stiffness of asphalt mixes as measured by creep tests; viscosity measurements on rolling thin film oven residues and asphalts recovered from mixes; aging properties; and cataloging and evaluating of the physical properties of 20 AC-20 asphalt cements. GRA

N76-20541# Mathematical Applications Group, Inc., Elmsford, N.Y.

SMITE: A SECOND ORDER EULERIAN CODE FOR HYDRODYNAMIC AND ELASTIC-PLASTIC PROBLEMS Final Contract Report

Samuel Z. Burstein, Harold S. Schechter, and E. L. Turkel Aberdeen Proving Ground, Md. BRL Aug. 1975 161 p

(Contract DAAD05-73-C-0512; DA Proj. 1T6-62618-AH-80) (AD-A016944; BRL-CR-255) Avail: NTIS CSCL 19/4

A computer code for hydrodynamic and elastic-perfectly plastic problems is described. The model uses a second order finite difference method based upon a Eulerian formulation of the basic differential equations. The algorithm uses an individual grid for each material domain, determined by Lagrangian type boundary points which are subject to free surface and interface conditions. The only communication between domains is through their common interfaces. GRA

N76-20542# Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

CORRELATION OF THEORETICAL AND EXPERIMENTAL DATA FOR HIGHWAY BRIDGES. VOLUME 2: MILITARY LOADING Final Report

Haaren A. Miklofsky Feb. 1975 182 p

Avail: NTIS HC $7.50 CSCL 13B

A computer program analytical routine SSAP2 is used to correlate a theoretical finite element analysis with experimental results for three typical two lane multi span girder and slab highway bridges in Tennessee. The programmed response for a fourth bridge is also included. All three bridges gave excellent correlation between predicted and experimental responses for deflection and moment distribution of the HET 7- loading to the main carrying members of the bridge. It is concluded that maximum stresses induced by future unique heavy military loads can be compared on a timely basis with the highway bridge structure's load carrying capability by use of the computerized theoretical method. GRA

N76-20543# Montana State Univ., Bozeman. Materials Bureau.

USE OF STYROFOAM UNDER CONCRETE SIDEWALKS Final Report

Stephen F. Weber Aug. 1974 51 p refs

(PB-246140/8) Avail: NTIS HC $4.50 CSCL 13B

The freezing characteristics under an insulated and uninsulated section of a sidewalk were examined. A 1 1/2 inch layer of styrofoam insulation was placed under a newly constructed sidewalk which replaced a one year old sidewalk that was failing from displacement by frost heaving. Temperature recordings were made during three winter seasons. Soil densities and moisture contents were monitored during the second season. The insulation was successful in eliminating heaving and cracking of the sidewalk for the three years. The effectiveness of an insulation barrier is evaluated in terms of time and prevailing air temperature. GRA

N76-20544# Army Construction Engineering Research Lab., Champaign, Ill.

NUMERICAL SOLUTION SCHEMES FOR HIGHLY NONLINEAR STATIC STRUCTURAL BEHAVIOR

John F. McNamara Oct. 1975 28 p refs Presented at US Army Numerical Analysis Conf., Philadelphia, 13-16 Feb. 1974

(AD-A016985; CERL-TM-M-102) Avail: NTIS CSCL 13/13

The feasibility and accuracy of a number of solution schemes for problems of static nonlinear structural response are studied. The structure is modeled by the finite element method, and the nonlinearities are mainly those of material behavior, but large displacement effects are also considered. It is shown that accepted solution approaches do not work as expected in the case of cyclic behavior of the structure around its limit load level. Results from two different finite element structural models are compared with those of an experiment for a simply supported beam undergoing load reversals at its midpoint. This simple example illustrates the numerical problems encountered in analyzing engineering structures under severe lateral loads which initiate failure modes in the structure. GRA

N76-20545# Naval Intelligence Support Center, Washington, D.C.

CALCULATION OF THE REINFORCED THIN-WALLED STRUCTURES BY THE METHOD OF FINITE ELEMENTS

Yu. I. Ivanov 30 Sep. 1975 15 p Transl. into ENGLISH from Tsentralnyi Aerogidrodinamicheskii Inst. Uchenye Zapiski (USSR), v. 3, no. 1, 1972 p 51-60

(AD-A016387; NISC-Trans-3692) Avail: NTIS CSCL 13/13

One variant of the finite element method is presented as applicable for calculations of the reinforced thin-walled structures (flat and curved panels, wings and empenage of different schemes, fuselage sections). The applicability of the method coupled with a computer programming is illustrated by several actual calculations. Theoretical results are compared with experimental data. GRA

N76-20546# Brookhaven National Lab., Upton, N.Y.

THE USE OF POLYMER CONCRETE FOR BRIDGE DECK REPAIRS ON THE MAJOR DEEGAN EXPRESSWAY Final Report

L. E. Kukacka, R. Mediatore, J. Fontana, M. Steinberg, and A. Levine Jan. 1975 45 p refs Sponsored by Fed. Highway Admin.

(PB-246048/3; BNL-19672) Avail: NTIS HC $4.00 CSCL 13C

The practicality of using polymer concrete repair holes in bridge decks has been demonstrated. The material cost of polymer concrete was $1,400 or $260-cu yd. This represented 4% of the total repair cost and indicates that the material cost is insignificant when repairs on major arterial highways are performed. The use of polymer concrete appears cost effective. GRA

N76-20547# Watervliet Arsenal, N.Y.
EXTERIOR COLLOCATION FOR THREE DIMENSIONAL SURFACE FLAWS
M. A. Hussian, R. F. Haggerty, S. L. Pu, and B. Noble (Wisc. Univ., Madison) Sep. 1975 40 p refs
(AD-A016922; WVT-TR-75053) Avail: NTIS CSCL 20/11

In the paper the problem of a three dimensional surface flaw is solved by the method of exterior collocation. Representing the shape of such a crack by a sector of a circle, the objective is to construct a set of harmonic functions such that the most stringent boundary conditions are satisfied exactly. These conditions are: the normal displacement is zero outside the crack surface and the normal stress is zero or prescribed inside the crack surface. There are additional boundary conditions due to the symmetry of the problem. Using integral forms of harmonic functions, the above conditions are satisfied and the rest of the boundary conditions exterior to the plane of the crack are then satisfied by collocation in the least square sense. GRA

N76-20548# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
VIBRATIONS OF AXIALLY LOADED STIFFENED CYLINDRICAL SHELLS WITH ELASTIC RESTRAINTS
Aviv Rosen and Josef Singer Jan. 1975 108 p refs
(Contract F44620-71-C-0116; Grant AF-AFOSR-2394-72)
(AD-A017568; TAE-208; AFOSR-75-1518TR) Avail: NTIS CSCL 20/11

A linear theory is derived for calculation of the influence of elastic edge restraints, on the vibrations and buckling of stiffened cylindrical shells. The stiffeners are considered 'smeared' and the edge restraints can be axial, radial, circumferential or rotational. Extensive computations are performed for special kinds of stringer-stiffened shells, and the theoretical predictions are compared with experimental results. A method of definition of equivalent elastically restrained boundary conditions by use of vibration tests is discussed. Application of this technique to tests on 10 shells significantly reduces the scatter in the ratio of experimental to predicted buckling loads. GRA

N76-20549# MSA Research Corp., Evans City, Pa.
THE EVALUATION OF FOAMED CONCRETE EXPLOSION-PROOF BULKHEADS Final Report
21 Feb. 1975 85 p refs
(Contract H0122109)
(PB-246571/4; BM-OFR-94-75) Avail: NTIS HC $5.00 CSCL 08I

Cast-in-place foamed concrete was investigated as a suitable bulkhead material for the construction of explosion-proof bulkheads in coal mines. Foamed concrete of density about 50 pcf meets the strength and permeability criteria and can be conveniently prepared and placed with available mine-approved equipment. Foamed concrete bulkheads should prove to be economical in situations where large numbers are to be installed, with savings over conventional techniques occurring in labor for the transport of supplies and the placement of bulkhead material. GRA

N76-20550# Raymond Technical Facilities, Inc., New York.
CONCEPT ANALYSIS, OFFSHORE BREAKWATER-OIL STORAGE SYSTEM
Joseph Peraino and Tomasz Plodowski Apr. 1975 67 p refs
(Contract DACW72-73-C-0005)
(AD-A010348; CERC-MP-4-75) Avail: NTIS CSCL 13/2

A method of providing a prompt and efficient answer to the fast-growing need for deep-draft berthing facilities along the U. S. east coast is developed. The general concept of large hollow precast floating units towed to the site, and sunk into position lends itself particularly to using the hollow interiors as storage space for liquid bulk cargo in large quantities. Since the trend for more economical transportation of petroleum products is by use of large deep-draft carriers, the combinations breakwater-oil storage system is a possible solution. Assumptions were made as to probable site conditions, i.e., water depths, sea conditions, bottom conditions, and a preliminary design developed for the units. Various construction procedures were studied and compared from both technical and construction cost aspects. GRA

N76-20551# Massachusetts Inst. of Tech., Cambridge.
NEW CONCEPTS IN SOIL-STABILIZER MIXING Final Report, Sep. 1970 - Jun. 1974
Anwar E. Z. Wissa, Nam P. Suh, R. Torrence Martin, and Nadium F. Fuleihan Mar. 1975 283 p refs
(Contract F29601-71-c-0067)
(AD-A007887; AFWL-TR-74-114) Avail: NTIS CSCL 13/2

A new mechanical concept for mixing wet plastic clays with stabilizers, namely the centrifugal mixing method, is presented. The centrifugal mixing method pelletizes the soil which can then be coated with a stabilizer. To evaluate new concepts of mixing, various direct and indirect methods for measuring mixing quality were developed and evaluated with particular emphasis on the simplicity of the tests and their adaptability to field use. The mechanical implications of the centrifugal mixing method, power requirements, and performance of the resulting stabilized soil evaluated show promise. GRA

N76-20552# MARC Analysis Research Corp., Providence, R.I.
FINITE ELEMENT TECHNIQUES FOR POSTULATED FLAWS IN SHELL STRUCTURES
Michael C. Apostal, Stephen Jordan, and Pedro V. Marcal Aug. 1975 211 p refs Sponsored by Elec. Power Res. Inst.
(PB-246257/0; EPRI-SR-22) Avail: NTIS HC $7.75 CSCL 20K

The basis and limitations of linear elastic fracture machanics (LEFM) are reviewed with an examination of available finite element methods and software. Since there is substantial interest in the application of LEFM to design, this report may serve as a basis for a continuing dialogue to exchange ideas and issues. Furthermore, the applicability of these methods to the particular class of problem involving flaws in shell structures is emphasized. Advantages and disadvantages of each method in turn are examined in the light of available published literature and the class of problem to which each is applicable. GRA

N76-20553# Failure Analysis Associates, Palo Alto, Calif.
FRACTURE MECHANICS AND RESIDUAL FATIGUE LIFE ANALYSIS FOR COMPLEX STRESS FIELDS
P. M. Besuner Jul. 1975 88 p refs Sponsored by Elec. Power Res. Inst.
(PB-246254/7; FAA-75-4-10; EPRI-217-1-TR-2) Avail: NTIS HC $5.00 CSCL 20K

The development and application of an influence function method is reviewed for calculating stress intensity factors and residual fatigue life for two- and three-dimensional structures with complex stress fields and geometries. Through elastic superposition, the method properly accounts for redistribution of stress as the crack grows through the structure. The analytical methods used and the computer programs necessary for computation and application of load independent influence functions are presented. A new exact solution is obtained for the buried elliptical crack, under an arbitrary Mode 1 stress field, for stress intensity factors at four positions around the crack front. The IF method is then applied to two fracture mechanics problems with complex stress fields and geometries. These problems are of current interest to the electric power generating industry and include the fatigue analysis of a crack in a pipe weld under nominal and residual stresses and fatigue analysis of a reactor pressure vessel nozzle corner crack under a complex bivariate stress field. GRA

N76-20554# Failure Analysis Associates, Palo Alto, Calif.
BOUNDARY-INTEGRAL EQUATION IN ENGINEERING STRESS AND FRACTURE MECHANICS
P. M. Besuner May 1975 40 p refs Sponsored by Elec. Power Res. Inst.
(PB-246253/9; FAA-75-3-14; EPRI-217-1-TR-3) Avail: NTIS HC $4.00 CSCL 20K

A boundary-integral equation (BIE) method, as employed by a computer program called PESTIE (Plane Elastic Solution Technique of Integral Equations), is described for application to engineering stress and fracture mechanics. A unique combination of several numerical analysis capabilities and user-oriented features that produce significant advantages over finite element programs and earlier BIE programs as described. These advantages are demonstrated by comparing numerical results and performance

of PESTIE with those of other programs for a series of stress concentration and stress intensity factor problems. GRA

N76-20555# Trinity Coll., Dublin (Ireland). School of Engineering.
FURTHER INVESTIGATIONS TOWARDS A RATIONAL METHOD OF DESIGN FOR FLEXIBLE PAVEMENTS Final Report, Apr. 1973 - Apr. 1974
R. W. Kirwan, T. E. Glynn, and M. S. Snaith Apr. 1974 70 p refs
(Contract DA-ERO-591-73-G0017; DA Proj. 2M0-611-B-52B)
(AD-A008099) Avail: NTIS CSCL 13/2

A finite element program has been developed to the stage that, given adequate material characterization, it may be used to analyze the effect of passing wheel loads on any proposed pavement structure. Until now such programs have examined the induced stresses and transient deflections of the pavement system. This program has the capability to predict the permanent strain accruing in any element of the pavement. It will then take these values and produce the surface profile of the pavement after any specified number of wheel loads has passed. To further this work a laboratory pavement simulator has been used to obtain load-deformation-time data for the program. Also the concepts of threshold and critical stresses to permanent deformation prediction have been examined together with two creep laws for boulder clays. GRA

N76-20556# Naval Research Lab., Washington, D.C.
FRACTURE TOUGHNESS OF LIGHT-WATER REACTOR PRESSURE VESSEL MATERIALS Progress Report, period ending 28 Feb. 1975
Frank J. Loss, J. Russell Hawthorne, and Christopher A. Griffis Apr. 1975 32 p refs
(Contract AT(49-25)-1003; NRL Proj. M01-40)
(AD-A009740; NRL-MR-3036) Avail: NTIS CSCL 11/6

The principal objectives are: (a) to characterize the dynamic fracture toughness of three heats of nuclear pressure vessel steel, namely, 6-in. A 302- B plate, 8-in. A 533- B Class 1 plate, and 9-in. A 508 Class 2 forging and (b) to develop techniques for the interpretation and analysis of notched, three-point bend specimens tested under impact loading. Author (GRA)

N76-20557# Georgia Dept. of Transportation, Atlanta. Office of Materials and Tests.
PAVEMENT FAULTING STUDY Final Report
Wouter Gulden May 1975 64 p refs Sponsored by DOT
(PB-246769/4) Avail: NTIS HC $4.50 CSCL 13B

The report describes the procedures and results of a study that was conducted by the Georgia Department of Transportation to determine the extent and causes of pavement faulting on the Interstate System in Georgia. Comparisons are made on the severity of faulting taking into account the type of subbase courses used and the accumulative volume of heavy truck traffic. The report further describes the results of the investigation into the causes of pavement faulting. Slab sections were removed at eight locations to determine the condition of the subbase and shoulder adjacent to the pavement. Recent design changes which have been made by Georgia in order to reduce the rate of faulting are discussed as well as present maintenance practices with respect to faulted pavements. It is concluded that the magnitude of faulting has increased significantly on some interstate sections between 1971 and 1974. It is further concluded that the faulting of joints in Georgia is the result of erosional effects produced by the infiltration of surface water and repeated passage of heavy axle loads which is causing a loss of erodible material from the top of the subbase and from the shoulder area. GRA

N76-20558# Lehigh Univ., Bethlehem, Pa. Engineering Lab.
DESIGN CRITERIA FOR STEEL I COLUMNS UNDER AXIAL LOAD AND BIAXIAL BENDING
D. A. Ross and Wai-Fah Chen Aug. 1975 34 p refs
(Grant NSF GK-35886)
(PB-246001/2; FEL-389.6; FEL-393.3A) Avail: NTIS HC $4.00 CSCL 13M

The design code Canadian Standard S16.1-1974 permits ultimate strength design steel H-columns subjected to axial load and biaxial bending moment. However, this is permitted only for sections in which the flange width to section depth ratio is equal to or greater than 0.8. In this paper a simple modification to the previous formulae is proposed which enables the restriction on flange width to section depth ratio to be removed so that they are also applicable to steel I-columns. GRA

N76-20559# Lehigh Univ., Bethlehem, Pa. Engineering Lab.
TEST PROGRAM OF MOMENT RESISTANT STEEL BEAM-TO-COLUMN WEB CONNECTIONS
Glen P. Rentschler and Wai-Fah Chen May 1975 44 p refs Sponsored jointly by Am. Iron and Steel Inst. and Welding Res. Council
(PB-245830/5; LEHIGH/FL/405-4) Avail: NTIS HC $4.00 CSCL 13M

Proceedings of meetings on beam-to-column web connections are presented. A program of tests on moment-resistant steel beam-to-column web connections is formulated. Author

N76-20560# Lehigh Univ., Bethlehem, Pa. Engineering Lab.
SOLUTIONS TO VARIOUS REINFORCED CONCRETE BEAM-COLUMN PROBLEMS
A. C. T. Chen and Wai-Fah Chen Sep. 1970 47 p refs
(Grant NSF GK-14274)
(PB-246109/3; LEHIGH/FL/370-2) Avail: NTIS HC $4.00 CSCL 13M

The column curvature curve concept, developed recently for the in-plane behavior of steel beam-columns, is applied herein to the solution of various reinforced concrete beam-column problems. Interaction curves relating thrust, slenderness ratios, eccentricity ratios, and/or lateral load for the maximum load carrying capacity of the reinforced concrete beam-columns are presented. GRA

N76-20561# Illinois Univ., Urbana. Dept. of Civil Engineering.
SAKE, A COMPUTER PROGRAM FOR INELASTIC RESPONSE OF R/C FRAMES TO EARTHQUAKES
Shunsuke Otani Nov. 1974 152 p refs
(Grant NSF GI-29934)
(PB-245317/3; UILU-ENG-74-2029; Ser-413) Avail: NTIS HC $6.75 CSCL 13M

A special purpose computer program was developed to analyze an inelastic reinforced concrete plane frame structure subjected to an intense earthquake motion in one horizontal direction. A reinforced concrete structure may consist of more than one regular rectangular unbraced frame of arbitrary numbers of stories and bays. The function, usage and background of the program are described with an example problem. GRA

N76-20562# California Univ., Berkeley. Earthquake Engineering Research Center.
AN EVALUATION OF SOME METHODS FOR PREDICTING SEISMIC BEHAVIOR OF REINFORCED CONCRETE BUILDINGS
Stephen A. Mahim and Vitelmo V. Bertero Feb. 1975 360 p refs
(Grants NSF GI-36387; NSF GI-424946; NSF GI-29933)
(PB-246306/5; EERC-75-5) Avail: NTIS HC $10.50 CSCL 13M

The seismic behavior of three reinforced concrete buildings that suffered significant structural damage during recent earthquakes was investigated. Two computer programs were developed for assessing the nonlinear dynamic response of reinforced concrete buildings subjected to strong earthquake ground motions. The ability of these nonlinear analytical techniques, as well as conventional linear elastic methods, to identify the principal parameters that controlled the seismic behavior of these prototype structures is evaluated. One of the computer programs developed during this investigation quantitatively evaluates the nonlinear characteristics of critical regions in reinforced concrete flexural members and estimates their ability to sustain inelastic deformations. GRA

N76-20563# California Univ., Berkeley. Earthquake Engineering Research Center.
A LITERATURE SURVEY. COMPRESSIVE, TENSILE, BOND AND SHEAR STRENGTH OF MASONRY
Ronald L. Mayes and Ray W. Clough Jun. 1975 211 p refs
(Grant NSF AEN-73-07732-A02)

(PB-246292/7; EERC-75-15) Avail: NTIS HC $7.75 CSCL 13C

The literature survey presented collates most of the available relevant information on the compressive, tensile, bond and shear strength of masonry. The report is divided into two chapters. The first, on the compressive, tensile and bond tests of small test specimens, summarizes information on the basic tests that determine different properties of nonhomogeneous, masonry assemblages. The second chapter summarizes most investigations performed on the shear strength of different assemblages and includes sections on test techniques, monotonic tests, model tests and cyclic tests. GRA

N76-20564# Illinois Univ., Urbana. Dept. of Civil Engineering.

THE SUBSTITUTE STRUCTURE METHOD FOR EARTHQUAKE-RESISTANT DESIGN OF REINFORCED CONCRETE FRAMES

Akenori Shibata and Mete A. Sozen Oct. 1974 38 p refs (Grant NSF GI-299934)

(PB-245318/1; UILU-ENG-74-2027; SER-412) Avail: NTIS HC $4.00 CSCL 13M

A procedure was developed which incorporated the effects of inelastic energy dissipation to determine the design force for a single-degree-of-freedom structure using the ordinary linear-response spectrum. The substitute-structure method extends this procedure to multi-degree-of-freedom structures. The proposed method can be used to determine earthquake design-force requirements for individual elements of a R/C structure given a design linear-response spectrum and explicit decisions about tolerable inelastic response, with the option of different limits of inelastic response in different structural elements. GRA

N76-20565# Coastal Engineering Research Center, Fort Belvoir, Va.

GUIDELINES FOR MONITORING SHORE PROTECTION STRUCTURES IN THE GREAT LAKES

Feb. 1975 37 p refs

(AD-A009500; CERC-MP-2-75) Avail: NTIS CSCL 13/2

The extent of wave damage to shores is difficult to predict; it is advisable to observe the behavior of the shore to determine if some protective action is required. After installation of a shore protection structure it is important to continue monitoring shore behavior and also to inspect for structural changes to determine if the structure is functioning as designed. Optimum and minimum plans for recording shoreline changes and monitoring groins, seawalls, revetments, and offshore breakwaters are given. Simple shore erosion computations and a data analysis program are presented. Author

N76-21126 European Space Agency, Paris (France).

OUTLINE OF A THEORY OF METAL PLASTIC FATIGUE BASED ON THE PROBABILITY OF INTRUSION FORMATION

Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 61-83 refs Transl. into ENGLISH from La Recherche Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 93-104 (For availability see N76-21123 11-99)

N76-21131 Ernst-Mach-Inst., Freiburg (West Germany).

TERMINAL BALLISTIC STUDIES OF THE EFFECTIVENESS OF MULTIPLE PLATE TARGETS AT HIGH IMPACT VELOCITIES

V. Hohler, H. Reichenbach, and A. Stilp *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 29-41 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21133 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).

EFFECT OF SHAPE AND STRENGTH OF MODEL FRAGMENTS ON THEIR EFFECTIVENESS

H. Senf *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 57-64 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21134 Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (West Germany).

CUMULATIVE FRAGMENT EFFECTS

M. Held *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 65-85 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21138 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).

FRAGMENTS PROJECTED BY HIGH EXPLOSIVES

U. Hornemann *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 141-147 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21139 Arbeitsgruppe fuer Physik der Hochdruckplasmen und Impulsentladungen, Erkrath (West Germany).

PENETRATION OF SHAPED CHARGE JETS IN STEEL TARGETS WITH TENSILE STRENGTHS BETWEEN 30 AND 300 kp/sq mm

K. Hollenberg *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 149-158 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21140 Studiengruppe Ballistik Schrobenhausen (West Germany).

EFFECTIVENESS DISPERSION OF SHAPED CHARGES

F. R. Thomanek *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 159-172 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21145 Battelle Inst., Frankfurt am Main (West Germany).

INVESTIGATIONS ON SPALL FRACTURE

H. U. Freund and W. Geiger *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 215-228 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

N76-21147 Battelle Inst., Frankfurt am Main (West Germany).

SIMULATION OF THE NUCLEAR EXPLOSION LOADING OF BURIED SHELTERS

P. Corvin, K. Metz, F. Rischbieter, and E. Schaepermeier *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 241-249 ref In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

42 GEOSCIENCES (GENERAL)

N76-20566*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

PROCEEDINGS OF THE GEODESY/SOLID EARTH AND OCEAN PHYSICS (GEOP) RESEARCH CONFERENCES

Ivan I. Mueller, ed. Sep. 1975 190 p refs Conference Reprints Conf. held at Columbus, Ohio, 1972 - 1974 Sponsored in part by Defense Mapping Agency, NOAA, and USGS

(Contract NASw-2435; OSURF Proj. 3511-A1)

(NASA-CR-146540; DGS-231) Avail: NTIS HC $7.50 CSCL 08E

Papers are presented dealing with interdisciplinary research in the fields of geodesy, solid earth and ocean physics. Topics discussed include: solid earth and ocean tides; the rotation of the earth and polar motion; vertical crustal motions; the geoid and ocean surface; earthquake mechanism; sea level changes; and lunar dynamics. For individual titles, see N76-20567 through N76-20574.

N76-20567* California Univ., La Jolla.

OCEAN TIDES **c48**

M. C. Hendershott *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 7-17 refs Repr. from Conf. Proc. E(Earth)S, v. 54, no. 2, Feb. 1973 Sponsored in part by Office of Naval Res. (For availability see N76-20566 11-42)

CSCL 08C

A review of recent developments in the study of ocean tides and related phenomena is presented. Topics briefly discussed include: the mechanism by which tidal dissipation occurs; continental shelf, marginal sea, and baroclinic tides; estimation of the amount of energy stored in the tide; the distribution of energy over the ocean; the resonant frequencies and Q factors of oceanic normal modes; the relationship of earth tides and ocean tides; and numerical global tidal models. J.M.S.

N76-20568* Memorial Univ. of Newfoundland, St. Johns.
THE EARTH'S ROTATION **c46**
M. G. Rochester *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 27-39 refs Repr. from Conf. Proc. E(Earth)S v. 54, no. 8, Aug. 1973 Sponsored in part by Natl. Res. Council of Can. (For availability see N76-20566 11-42)
CSCL 08E

The state-of-the-art technology in the study of the three dimensional rotation of the earth about its center of mass is summarized. A survey of appropriate reference frames and problems involved in defining them is given along with an outline of the accuracy with which the earth's rotation can be measured relative to these frames. The various spectral features of changes in the axis orientation and spin rate of the solid earth and the physical mechanisms known or likely to effect and/or affect them are discussed. Author

N76-20569* Scripps Institution of Oceanography, La Jolla, Calif.
EPEIROGENY AND PLATE TECTONICS **c46**
Henry W. Menard *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 51-62 refs Repr. from Conf. Proc. E(Earth)S, v. 54, no. 12, Dec. 1973 (For availability see N76-20566 11-42) (Grant NSF GA-39219)
CSCL 08E

Vertical motions of the earth crust and their causes are considered in relation to epeirogenic phenomena. Factors discussed include: external loading and unloading; bending at subduction zones; internal density changes; and dynamic effects of mantle motion. The relationship between epeirogeny and drift is briefly reviewed along with oceanic epeirogeny. J.M.S.

N76-20570* Ohio State Univ. Research Foundation, Columbus.
THE GEOID: DEFINITION AND DETERMINATION **c46**
Richard H. Rapp *In its* Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 69-77 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 3, Mar. 1974 (For availability see N76-20566 11-42)
CSCL 08E

The principles and problems relative to the determination of the geoid are outlined. Factors discussed include: gravity data requirements for a precise geoid; mean sea level; and satellite altimetry. It is indicated that geoid undulations can be determined on a global basis to plus or minus 3 m. Application of geoid information to oceanography and the determination of sea surface topography considered. J.M.S.

N76-20571* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEODETIC AND DYNAMICAL PROPERTIES OF PLANETS **c91**
John D. Anderson *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 85-93 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 5, May 1974 (For availability see N76-20566 11-42) (Contract NAS7-100)
CSCL 03B

The state-of-the-art of planetary dynamics and geodesy is reviewed along with sources of planetary data. Factors considered include: gravity fields; shape and topography; planetary rotations; and planetary interiors. Construction of theoretical models for Jupiter and Saturn is briefly discussed in terms of the impact of Pioneer and Mariner missions. J.M.S.

N76-20572* California Univ., San Diego.
CURRENT STATUS OF UNDERSTANDING QUASI-PERMANENT FIELDS ASSOCIATED WITH EARTHQUAKES **c46**
James N. Brune *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 103-110 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 9, Sep. 1974 (For availability see N76-20566 11-42)
CSCL 08K

The basic concepts relating to displacement fields associated with earthquakes are described. Factors discussed include: understanding the geologic and tectonic setting, the discovery of fault creep, and an extended range of possible models of strain buildup. Problems in tectonic modeling reviewed relate to understanding (1) frictional heat generation on faults, (2) the character of stress and strain on faults below the depth of earthquakes, and (3) the predictability of major earthquakes. Author

N76-20573* Department of Energy, Mines and Resources, Ottawa (Ontario).
RECENT AND LATE QUATERNARY CHANGES IN WATER LEVEL **c46**
Richard I. Walcott *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 117-127 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 2, Feb. 1975 (For availability see N76-20566 11-42) (Contrib-519) CSCL 08H

Water level changes of both the Great Lakes and the sea are described along with methods of analyzing water level data. The influence of elastic deformation of the earth and viscosity is discussed. Causes of water level changes reviewed include: earth movements, geoid changes, storm surges or meteorological phenomena, and melting ice in Antarctica, Greenland, and the mountain glaciers. J.M.S.

N76-20574* California Univ., Los Angeles. Dept. of Planetary and Space Sciences.
THE GRAVITY AND SHAPE OF THE MOON **c91**
William M. Kaula *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 139-146 refs Repr. from Conf. Proc. E(Earth)S, v. 56, no. 6, Jun. 1975 (For availability see N76-20566 11-42) (Contract NAS9-12757; Grants NGL-05-007-002; NGL-05-007-283)
(Publ-1392) CSCL 03B

Measurements of the gravity and geometry of the moon are described relative to lunar structure. Measurements pertaining to the gravity field include, Doppler tracking of spacecraft that have orbited the moon, laser ranging from the earth to the moon, and the gravity meters and accelerometers landed with the Apollo spacecraft. Measurements pertaining to the geometry include (1) those related to the shape; the metric photography and laser altimeters on Apollo 15, 16, and 17; the electromagnetic sounder on Apollo 17; the landmark tracking from earlier Apollo orbiters; and occultations, plus (2) measurements related to he orientation: the laser ranging and interferometry from the earth. Author

N76-20575*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
IDENTIFYING UNKNOWN MINERALS AND COMPOUNDS FROM X-RAY DIFFRACTION PATTERNS USING THE JOHNSON AND VAND FORTRAN 4 COMPUTER PROGRAM
Frank T. Kyte (San Jose State Univ., Calif.) Jan. 1976 44 p (NCA-2-OR-675-514)
(NASA-TM-X-73092) Avail: NTIS HC $4.00 CSCL 08G

Automated computer identification of minerals and compounds from unknown samples is provided along with detailed instructions and worked examples for use in graduate level courses in mineralogy and X-ray analysis applications. Author

N76-20576*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH AND OCEAN DYNAMICS PROGRAM
F. O. VonBun Feb. 1976 32 p refs Presented at meeting of the Royal Society, London, 26-27 Feb. 1976
(NASA-TM-X-71089; X-900-76-39) Avail: NTIS HC $4.00 CSCL 08E

The objectives and requirements of the Earth and Ocean Dynamics Programs are outlined along with major goals and

experiments. Spaceborne as well as ground systems needed to accomplish program goals are listed and discussed along with program accomplishments. J.M.S.

N76-21149 Technical Univ. of Norway, Trondheim. Inst. of Mechanics.
ON THE POSSIBILITY OF APPLYING A THEORETICAL APPROACH TO PROBLEMS IN ROCK DYNAMICS
L. N. Persen *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 275-288 refs (For availability see N76-21129 11-99)
(Contract F44620-75-C-0029)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N76-20577*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
EARTH RESOURCES EVALUATION FOR NEW MEXICO BY LANDSAT-2 Progress Report, 1 Dec. 1975 - 29 Feb. 1976
David E. Tabet, Principal Investigator, Frank E. Kottlowski, Michael H. Inglis, Linda L. Love, and Stanley A. Morain 29 Feb. 1975 4 p refs ERTS
(Contract NAS5-20916)
(E76-10226; NASA-CR-146337) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-20578*# Alaska Univ., Fairbanks. Alaska Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Progress Report
Peter C. Lent, Principal Investigator. 8 Mar. 1976 4 p ref ERTS
(Contract NAS5-20915)
(E76-10227; NASA-CR-146431; PR-3) Avail: NTIS HC 3.50 CSCL 06C

The author has identified the following significant results. Winter and summer moose range maps of three selected areas were produced (1:63,360 scale). The analytic approach is very similar to modified clustering. Preliminary results indicate that this method is not only more accurate but considerably less expensive than supervised classification techniques.

N76-20579*# Ohio Dept. of Economic and Community Development, Columbus.
UTILIZING SKYLAB DATA IN ON-GOING RESOURCES MANAGEMENT PROGRAMS IN THE STATE OF OHIO Final Report, Apr. - Aug. 1975
P. E. Baldridge, Principal Investigator, P. H. Goesling, T. A. Martin, G. E. Wukelic (Battelle Columbus Labs., Ohio), J. G. Stephan (Battelle Columbus Labs., Ohio), H. E. Smail (Battelle Columbus Labs., Ohio), and T. F. Ebbert (Battelle Columbus Labs., Ohio) Nov. 1975 139 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS3-19521)
(E76-10229; NASA-CR-134938) Avail: NTIS HC $6.00 CSCL 05B

The author has identified the following significant results. The use of Skylab imagery for total area woodland surveys was found to be more accurate and cheaper than conventional surveys using aerial photo-plot techniques. Machine-aided (primarily density slicing) analyses of Skylab 190A and 190B color and infrared color photography demonstrated the feasibility of using such data for differentiating major timber classes including pines, hardwoods, mixed, cut, and brushland providing such analyses are made at scales of 1:24,000 and larger. Manual and machine-assisted image analysis indicated that spectral and spatial capabilities of Skylab EREP photography are adequate to distinguish most parameters of current, coal surface mining concern associated with: (1) active mining, (2) orphan lands, (3) reclaimed lands, and (4) active reclamation. Excellent results were achieved when comparing Skylab and aerial photographic interpretations of detailed surface mining features. Skylab photographs when combined with other data bases (e.g., census, agricultural land productivity, and transportation networks), provide a comprehensive, meaningful, and integrated view of major elements involved in the urbanization/encroachment process.

N76-20580*# Geological Survey, Reston, Va.
IMPROVING ESTIMATES OF STREAMFLOW CHARACTERISTICS USING LANDSAT-1 (ERTS-1) IMAGERY Final Report, 1 Jul. 1972 - 30 Jun. 1975
Este F. Hollyday, Principal Investigator 31 Aug. 1975 64 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E76-10230; NASA-CR-146513) Avail: NTIS HC $4.50 CSCL 08H

The author has identified the following significant results. Streamflow characteristics in the Delmarva Peninsula derived from the records of daily discharge of 20 gaged basins are representative of the full range in flow conditions and include all of those commonly used for design or planning purposes. They include annual flood peaks with recurrence intervals of 2, 5, 10, 25, and 50 years, mean annual discharge, standard deviation of the mean annual discharge, mean monthly discharges, standard deviation of the mean monthly discharges, low-flow characteristics, flood volume characteristics, and the discharge equalled or exceeded 50 percent of the time. Streamflow and basin characteristics were related by a technique of multiple regression using a digital computer. A control group of equations was computed using basin characteristics derived from maps and climatological records. An experimental group of equations was computed using basin characteristics derived from LANDSAT imagery as well as from maps and climatological records. Based on a reduction in standard error of estimate equal to or greater than 10 percent, the equations for 12 stream flow characteristics were substantially improved by adding to the analyses basin characteristics derived from LANDSAT imagery.

N76-20581*# Mississippi State Office of Science and Technology, Jackson.
APPLICATION AND EVALUATION OF SATELLITE REMOTE SENSING DATA AND AUTOMATIC PROCESSING TECHNIQUES FOR STATE-WIDE LAND USE AND OTHER RESOURCE MANAGEMENT Progress Report, period ending 21 Jan. 1976
P. T. Bankston, Principal Investigator Jan. 1976 6 p ERTS
(Contract NAS5-20918)
(E76-10231; NASA-CR-146514) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-20582*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 Nov. 1975 - 15 Feb. 1976
Richard F. Nalepka, John Colwell, Principal Investigators, and Daniel P. Rice 15 Feb. 1976 24 p refs ERTS
(Contract NAS5-22389)
(E76-10232; NASA-CR-146515; ERIM-114800-12-L) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-20583*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Dec. 1975 - 19 Mar. 1976
Daniel J. Deely, Principal Investigator 19 Mar. 1976 8 p ERTS
(Contract NAS5-21998)
(E76-10233; NASA-CR-146516; C-1037-2-4;

Rept-21570-2-4) Avail: NTIS HC $3.50 CSCL 08I
There are no author-identified significant results in this report.

N76-20584*# Nebraska Univ., Lincoln. Conservation and Survey Div.
APPLICATION OF LANDSAT IMAGERY IN LAND USE INVENTORY AND CLASSIFICATION IN NEBRASKA Progress Report, 10 Dec. 1975 - 10 Mar. 1976
Marvin P. Carlson, Principal Investigator and Paul M. Seevers 10 Mar. 1976 5 p ERTS
(Contract NAS5-20814)
(E76-10236; NASA-CR-146519) Avail: NTIS HC $3.50 CSCL 08B
There are no author-identified significant results in this report.

N76-20585*# National Oceanic and Atmospheric Administration, Washington, D.C.
EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report
Donald R. Wiesnet, David F. McGinnis, Jr., Principal Investigators, and Michael C. McMillan 12 Mar. 1976 6 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-3991A)
(E76-10237; NASA-CR-146520) Avail: NTIS HC $3.50 CSCL 08H
There are no author-identified significant results in this report.

N76-20586*# Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Sep. 1975
David L. Tingley and John Potter, Principal Investigators 1975 1 p EREP
(Contract NAS9-13303)
(E76-10238; NASA-CR-146521) Avail: NTIS HC $3.50 CSCL 04A
There are no author-identified significant results in this report.

N76-20587*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIR ON THE ENVIRONMENT AND ECOLOGY Progress Report, 1 Jan. - 31 Mar. 1976
Ravinder K. Jain, Principal Investigator 29 Mar. 1976 3 p ERTS
(E76-10239; NASA-CR-146522) Avail: NTIS HC $3.50 CSCL 08H
There are no author-identified significant results in this report.

N76-20588*# Utah Univ., Salt Lake City. Coll. of Mines.
REMOTE SENSING IN MINERAL EXPLORATION FROM LANDSAT IMAGERY Quarterly Report, Oct. - Dec. 1975
M. P. Nackowski, Principal Investigator 11 Feb. 1976 8 p ERTS
(Contract NAS5-20955)
(E76-10240; NASA-CR-146523) Avail: NTIS HC $3.50 CSCL 08G
The author has identified the following significant results. Preliminary statistical analysis of length and azimuth of linear stream segments in the Battle Mountain area suggest that segment length (discriminating criterion) can be used to distinguish mineralized from nonmineralized areas.

N76-20589*# Utah Univ., Salt Lake City. Coll. of Mines.
REMOTE SENSING IN MINERAL EXPLORATION FROM LANDSAT IMAGERY Quarterly Report, Jun. - Sep. 1975
M. P. Nackowski, Principal Investigator 3 Nov. 1975 4 p ERTS
(Contract NAS5-20955)
(E76-10241; NASA-CR-146524) Avail: NTIS HC $3.50 CSCL 14E
There are no author-identified significant results in this report.

N76-20590*# California State Dept. of Water Resources, Sacramento.
[WATER QUALITY CONDITIONS IN SAN FRANCISCO BAY DELTA] Progress Report
Randall L. Brown, Principal Investigator 15 Jan. 1976 2 p ERTS
(Contract NAS5-20945)
(E76-10242; NASA-CR-146525; PR-2) Avail: NTIS HC $3.50 CSCL 05B
There are no author-identified significant results in this report.

N76-20591*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
[ENVIRONMENTAL EFFECTS OF STRIP MINING] Quarterly Progress Report, 21 Aug. - 21 Nov. 1975
Birney R. Fish, Principal Investigator 21 Nov. 1975 3 p Sponsored by NASA ERTS
(E76-10243; NASA-CR-146526; QPR-3) Avail: NTIS HC $3.50 CSCL 05B
There are no author-identified significant results in this report.

N76-20592*# Eason Oil Co., Oklahoma City, Okla.
EVALUATION OF THE SUITABILITY OF SKYLAB DATA FOR THE PURPOSE OF PETROLEUM EXPLORATION Final Report
Robert J. Collins, Principal Investigator, Gerald J. Petzel, and John R. Everett (Earth Satellite Corp., Washington, D. C.) Dec. 1975 158 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13297)
(E76-10244; NASA-CR-147468) Avail: NTIS HC $6.75 CSCL 08G
There are no author-identified significant results in this report.

N76-20593*# Geological Survey, Washington, D.C.
PREPARATION OF A GEOLOGIC PHOTO MAP AND HYDROLOGIC STUDY OF THE YEMEN ARAB REPUBLIC Quarterly Report, Dec. 1975
D. F. Davidson, Principal Investigator Dec. 1975 3 p ERTS
(E76-10246; NASA-CR-146528) Avail: NTIS HC $3.50 CSCL 08F
There are no author-identified significant results in this report.

N76-20594*# Missouri Univ., Rolla.
STRUCTURAL AND GROUND PATTERN ANALYSIS OF MISSOURI AND THE OZARK DOME USING LANDSAT-2 SATELLITE IMAGERY Quarterly Progress Report, Jul. - Sep. 1975
Geza Kisvarsanyi and Eva B. Kisvarsanyi, Principal Investigators Sep. 1975 11 p refs ERTS
(Contract NAS5-20937)
(E76-10247; NASA-CR-146529; QPR-2) Avail: NTIS HC $3.50 CSCL 08E
There are no author-identified significant results in this report.

N76-20595*# Federation of Rocky Mountain States, Inc., Denver, Colo.
A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Jul. - 10 Oct. 1975
George Nez, Principal Investigator 10 Oct. 1975 33 p ERTS
(Contract NAS5-22338)
(E76-10248; NASA-CR-146530; QR-2) Avail: NTIS HC $4.00 CSCL 08B
There are no author-identified significant results in this report.

N76-20596*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report

Paul E. Baldridge, Principal Investigator 10 Sep. 1975 2 p ERTS
(Contract NAS5-22399)
(E76-10249; NASA-CR-146623) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-20597*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT-2 (ERTS) IMAGES APPLIED TO GEOLOGIC STRUCTURES AND MINERAL RESOURCES OF SOUTH AMERICA Progress Report, 14 Mar. - 30 Jun. 1975
William D. Carter, Principal Investigator 1 Jul. 1975 44 p refs Sponsored by NASA ERTS
(E76-10250; NASA-CR-146624) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. Work with the Image 100 clearly demonstrates that radiance values of LANDSAT data can be used for correlation of geologic formations across international boundaries. The Totora Formation of the Corocoro Group of Tertiary age was traced from known outcrops near Tiahuanaco, Bolivia, along the south side of Lake Titicaca westward into Peru where the same rocks are considered to be Cretaceous in age. This inconsistency suggests: (1) that a review of this formation is needed by joint geological surveys of both countries to determine similarities, differences, and the true age; (2) that recognition of the extension of the copper-bearing Totora Formation of Bolivia into Peru may provide Peru with a new target for exploration. Equal radiance maps made by use of the Image 100 system show as many as eight different units within salar deposits (salt flats) of the Bolivian Altiplano. Standard film processed images show them as nearly uniform areas of white because of lack of dynamic range in film products. The Image 100 system, therefore, appears to be of great assistance in subdividing the salt flats on the basis of moisture distribution, surface roughness, and distribution of windblown materials. Field work is needed to determine these relationships to mineral composition and distribution. Images representing seasonal changes should also improve the accuracy of such maps. Radiance values of alteration zones related to the occurrence of porphyry copper ores were measured at the San Juan del Abra deposit of northern Chile using the Image 100 system. The extent to which these same values may be used to detect similar alteration zones in other areas has not yet been tested.

N76-20598*# Geological Survey, Denver, Colo. Branch of Petrophysics and Remote Sensing.
A PHOTOGEOLOGIC COMPARISON OF SKYLAB AND LANDSAT IMAGES OF SOUTHWESTERN NEVADA AND SOUTHEASTERN CALIFORNIA Final Report
D. W. OLeary and H. A. Pohn, Principal Investigators [1975] 79 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-6555-B)
(E76-10251; NASA-CR-144642) Avail: NTIS HC $5.00 CSCL 08B

There are no author-identified significant results in this report.

N76-20599*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF PHOTOINTERPRETATIVE TECHNIQUES TO WHEAT IDENTIFICATION, SIGNATURE EXTENSION, AND SAMPLING STRATEGY Quarterly Progress Report, 16 Aug. - 15 Nov. 1975
R. N. Calwell, Principal Investigator, C. M. Hay, and R. W. Thomas 29 Jan. 1976 63 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14565)
(E76-10252; NASA-CR-147506; SSL-Ser-17-Issue-3) Avail: NTIS HC $4.50 CSCL 02C

There are no author-identified significant results in this report.

N76-20600*# National Marine Fisheries Service, Bay Saint Louis, Miss. Technology Div.
LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 30 Jul. - 31 Oct. 1975
Andrew J. Kemmerer, Principal Investigator Oct. 1975 48 p ERTS
(NASA Order S-54114)
(E76-10253; NASA-CR-146625; SEFC-Contrib-434; MARMAP-Contrib-106) Avail: NTIS HC $4.00 CSCL 08A

The author has identified the following significant results. The most significant achievement realized thus far has been the successful completion of the data acquisition phase. This success must be attributed to the interest, support, and competency of the participants. The apparent consistency of water color and turbidity condition over time and between test sites at sites of menhaden capture is significant especially since color is readily measured with satellite and aircraft sensors and a LANDSAT MSS based computer model for inferring tubidity has been developed.

N76-20601*# Agriculture Dept., Hyattsville, Md.
GYPSY MOTH DEFOLIATION ASSESSMENT: FOREST DEFOLIATION IN DETECTABLE FROM SATELLITE IMAGERY Final Report, 1973
Harry J. Moore, Principal Investigator and Wayne G. Rohde Sep. 1975 18 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70251-AG)
(E76-10254; NASA-CR-146626) Avail: NTIS HC $3.50 CSCL 02F

The author has identified the following significant results. ERTS-1 imagery obtained over eastern Pennsylvania during July 1973, indicates that forest defoliation is detectable from satellite imagery and correlates well with aerial visual survey data. It now appears that two damage classes (heavy and moderate-light) and areas of no visible defoliation can be detected and mapped from properly prepared false composite imagery. In areas where maple is the dominant species or in areas of small woodlots interspersed with agricultural areas, detection and subsequent mapping is more difficult.

N76-20602*# Environmental Research and Technology, Inc., Concord, Mass.
THE USE OF LANDSAT DATA TO STUDY MESOSCALE CLOUD FEATURES Quarterly Progress Report, Jul. - Sep. 1975
Mary Grace Fowler, Principal Investigator, C. James Bowley, Pieter Feteris, and Anthony Lisa Oct. 1975 14 p ERTS
(Contract NAS5-20804)
(E76-10255; NASA-CR-146627; P-619-3) Avail: NTIS HC $3.50 CSCL 04B

There are no author-identified significant results in this report.

N76-20603*# Wisconsin Univ., Milwaukee Air Pollution Analysis Lab.
USE OF LANDSAT DATA IN MONITORING PATTERNS OF AEROSOL POLLUTANTS AND MESOMETEOROLOGICAL EVENTS Final Report
Walter A. Lyons, Principal Investigator Sep. 1975 64 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21736)
(E76-10256; NASA-CR-146628) Avail: NTIS HC $4.50 CSCL 13B

There are no author-identified significant results in this report.

N76-20604*# Norsk Polarinstitutt, Oslo.
GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA Quarterly Progress Report
Olav Orheim, Principal Investigator 24 Mar. 1976 4 p Sponsored by NASA and Royal Norwegian Council for Sci. and Industrial Res. ERTS

(E76-10258; NASA-CR-146630; QPR-2) Avail: NTIS HC $3.50 CSCL 08A

There are no author-identified significant results in this report.

N76-20605*# College for Civil Engineering, Bucharest (Romania). Lab. for Remote Sensing.

USE OF LANDSAT DATA FOR RESOURCES INVESTIGATION IN THE LOWER BASIN OF DANUBE AND DANUBE DELTA Progress Report, May - Dec. 1975

Nicolaie Oprescu, Principal Investigator Dec. 1975 13 p Sponsored by NASA ERTS

(E76-10259; NASA-CR-146631; DaDelta-1/1) Avail: NTIS HC $3.50 CSCL 08H

The author has identified the following significant results. A most important is that bands 4 and 5 very clearly show the sedimentary discharge into the sea and the spreading regime in the sea at the mouth of the Danube and out at sea at great distances to over 100 km. Another particularly significant result is shown by bands 6 and 7, presenting the successive stages of sediments in the Danube Delta, with the clear marking of the separation between the fluvial and marine delta. The survey of floods and of some of their effects may also be studied on all of the bands in the complex area of the Danube Delta and in the lower basin of the Danube.

N76-20606*# Department of Scientific and Industrial Research, Wellington (New Zealand).

LANDSAT INVESTIGATION PROGRAM. PART 1: DEVELOPMENT OF REMOTE SENSING TECHNOLOGY IN NEW ZEALAND. PART 2: MAPPING LAND USE AND ENVIRONMENTAL STUDIES IN NEW ZEALAND. PART 3: INDIGENOUS FOREST ASSESSMENT. PART 4: SEISMOTECTONIC, STRUCTURAL, VOLCANOLOGIC AND GEOMORPHIC STUDY OF NEW ZEALAND Quarterly Report

Mervyn C. Probine, Richard P. Suggate, Ian F. Stirling, and Michael G. McGreevy, Principal Investigators Mar. 1976 49 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10260; NASA-CR-146632; Rept-508; QR-1) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-20607*# California Univ., Berkeley. Space Science Lab.

DIGITAL HANDLING AND PROCESSING OF REMOTE SENSING DATA Final Report, Jul. 1972 - Jul. 1973

Robert N. Colwell, V. Ralph Algazi, Principal Investigators, D. J. Sakrison, J. Schriebman, W. Dere, B. Romberger, and A. Samulon 1974 89 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-21827)

(E76-10262; NASA-CR-146634; SSL-SER-16-Issue-66; Rept-5-21827(ERTS)) Avail: NTIS HC $5.00 CSCL 05B

The author has identified the following significant results. A systematic approach to the enhancement of images was developed. This approach exploits two principal features involved in the observation of images: the properties of human vision and the statistics of the images being observed. The stripping effect is greatly magnified as images are enhanced digitally for visibility in the water; the range of useful sensor outputs is then quite narrow and errors are more significant. It is possible to bring about some improvement on image quality by equalizing the sensors response based on statistics of the received data.

N76-20608*# Texas Univ., Austin.

DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE Quarterly Report, Dec. - Feb. 1976

Ron Jones, Principal Investigator (General Land Office, Austin, Tex.), Peggy Harwood (General Land Office, Austin, Tex.), Robert Finley, George Clements (Texas Parks and Wildlife Dept., Austin), Larry Lodwick (Texas Parks and Wildlife Dept., Austin), Samuel McCulloch (Texas Water Development Board, Austin), and David Marphy (Texas Water Development Board, Austin) Mar. 1976 56 p refs ERTS

(Contract NAS5-20986)

(E76-10263; NASA-CR-146635) Avail: NTIS HC $4.50 CSCL 08C

The author has identified the following significant results. The most significant ADP result was the modification of the DAM package to produce classified printouts, scaled and registered to U.S.G.S., 71/2 minute topographic maps from LARSYS-type classification files. With this modification, all the powerful scaling and registration capabilities of DAM become available for multiclass classification files. The most significant results with respect to image interpretation were the application of mapping techniques to a new, more complex area, and the refinement of an image interpretation procedure which should yield the best results.

N76-20609*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Jun. - 30 Nov. 1975

R. A. Weismiller, Principal Investigator 30 Nov. 1975 77 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Grant NGL-15-005-186)

(E76-10264; NASA-CR-146636) Avail: NTIS HC $5.00 CSCL 08F

There are no author-identified significant results in this report.

N76-20610*# South Dakota State Univ., Brookings. Remote Sensing Inst.

INVESTIGATION OF REMOTE SENSING TO DETECT NEAR-SURFACE GROUNDWATER ON IRRIGATED LANDS

Dennis W. Ryland, Fred A. Schmer, and Donald G. Moore Oct. 1975 48 p Sponsored by NASA

(Contract DI-14-06-700-7466)

(NASA-CR-146550; SDSU-RSI-75-10) Avail: NTIS HC $4.00 CSCL 08H

The application of remote sensing techniques was studied for detecting areas with high water tables in irrigated agricultural lands. Aerial data were collected by the LANDSAT-1 satellite and aircraft over the Kansas/Bostwick Irrigation District in Republic and Jewell Counties, Kansas. LANDSAT-1 data for May 12 and August 10, 1973, and aircraft flights (midday and predawn) on August 10 and 11, 1973, and June 25 and 26, 1974, were obtained. Surface and water table contour maps and active observation well hydrographs were obtained from the Bureau of Reclamation for use in the analysis. Results of the study reveal that LANDSAT-1 data (May MSS band 6 and August MSS band 7) correlate significantly (0.01 level) with water table depth for 144 active observation wells located throughout the Kansas/Bostwick Irrigation District. However, a map of water table depths of less than 1.83 meters prepared from the LANDSAT-1 data did not compare favorably with a map of seeped lands of less than 1.22 m (4 feet) to the water table. Field evaluation of the map is necessary for a complete analysis. Analysis of three fields on a within or single-field basis for the 1973 LANDSAT-1 data also showed significant correlation results. Author

N76-20611*# Scientific Translation Service, Santa Barbara, Calif.

USE OF REMOTE SENSORS IN THE VERACRUZ FLORA PROGRAM

M. Soto, A. Gomez-Pompa, F. Menendez, and G. Arp Washington NASA Apr. 1976 11 p Transl. into ENGLISH of "Uso de los Sensores Remotos en el Programma Flora de Veracruz" (unpublished report) Mexico City, Mexico Univ., 1976 8 p

(Contract NASw-2791)

(NASA-TT-F-16943) Avail: NTIS HC $3.50 CSCL 08F

Use of remote sensing in some of the investigations which are being carried out within the Veracruz Flora Program are presented. This includes digitalization of the climate map of the State of Veracruz for the purpose of obtaining automatic

correlations between species, locality where it is found, and type of climate. Author

N76-20612*# Environmental and Regional Research Associates, Inc., Johnson City, Tenn.
TOWARD THE MODELING OF LAND USE CHANGE: A SPATIAL ANALYSIS USING REMOTE SENSING AND HISTORICAL DATA Final Report
Robert B. Honea Feb. 1976 194 p refs
(Contract NAS8-30595)
(NASA-CR-144221; ERRA-73-48-Y) Avail: NTIS HC $7.50 CSCL 08B

It was hypothesized that the chronological observation of land use change could be shown to follow a predictable pattern and these patterns could be correlated with other statistical data to develop transition probabilities suitable for modeling purposes. A literautre review and preliminary research, however, indicated a totally stochastic approach was not practical for simulating land use change and thus a more deterministic approach was adopted. The approach used assumes the determinants of the land use conversion process are found in the market place, where land transactions among buyers and sellers occur. Only one side of the market transaction process is studied, however, namely, the purchaser's desires in securing an ideal or suitable site. The problem was to identify the ideal qualities, quantities or attributes desired in an industrial site (or housing development), and to formulate a general algorithmic statement capable of identifying potential development sites. Research procedures involved developing a list of variables previously noted in the literature to be related to site selection and streamlining the list to a set suitable for statistical testing. A sample of 157 industries which have located (or relocated) in the 16-county Knoxville metropolitan region since 1950 was selected for industrial location analysis. Using NASA color infrared photography and Tennessee Valley Authority historical aerial photography, data were collected on the spatial characteristics of each industrial location event. These data were then subjected to factor analysis to determine the interrelations of variables. Author

N76-20613*# Agricultural Research Service, Phoenix, Ariz.
SOIL WATER CONTENT AND EVAPORATION DETERMINED BY THERMAL PARAMETERS OBTAINED FROM GROUND-BASED AND REMOTE MEASUREMENTS Final Report
R. Reginato, S. Idso, J. Vedder, R. Jackson, M. Blanchard, and R. Goettelman [1975] 44 p refs Repr. from Sci., v. 189, 19 Sep. 1975 p 991-992
(NASA Order S-53769-A)
(NASA-CR-144733; RFP5-39531-255) Avail: NTIS HC $4.00 CSCL 08L

A procedure is presented for calculating 24-hour totals of evaporation from wet and drying soils. Its application requires a knowledge of the daily solar radiation, the maximum and minimum, air temperatures, moist surface albedo, and maximum and minimum surface temperatures. Tests of the technique on a bare field of Avondale loam at Phoenix, Arizona showed it to be independent of season. Author

N76-20614*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF LAKE ICE THICKNESS WITH A SHORT-PULSE RADAR SYSTEM
Dale W. Cooper, Robert A. Mueller, and Ronald J. Schertler Washington Mar. 1976 25 p refs
(NASA-TN-D-8189; E-8573) Avail: NTIS HC $3.50 CSCL 08L

Measurements of lake ice thickness were made during March 1975 at the Straits of Mackinac by using a short-pulse radar system aboard an all-terrain vehicle. These measurements were compared with ice thicknesses determined with an auger. Over 25 sites were explored which had ice thicknesses in the range 29 to 60 cm. The maximum difference between radar and auger measurements was less than 9.8 percent. The magnitude of the error was less than + or - 3.5 cm. The NASA operating short-pulse radar system used in monitoring lake ice thickness from an aircraft is also described. Author

N76-20615# DBA Systems, Inc., Melbourne, Fla.
THE COMBINATION OF GRAVITY AND SATELLITE ALTIMETRY DATA FOR DETERMINING THE GEOID SURFACE Final Report, Nov. 1974 - Aug. 1975
Georges Blaha Aug. 1975 116 p refs
(Contract F19628-75-C-0069)
(AD-A015828; AFCRL-TR-75-0347) Avail: NTIS CSCL 08/5

A recent report by Brown (1973) initiated a new approach to satellite altimetry adjustment, in the sense that highly accurate reference orbits are no longer required. Computer simulations indicated that in this way, global oceanic geoid accurate to within 1 to 2 meters rms may be determined from the reduction of GEOS-C satellite observations. However, worthwhile geoidal accuracies cannot be obtained over land masses from the reduction of satellite altimetry alone. GRA

N76-20616# Bureau of Mines, Amarillo, Tex. Helium Div.
ANALYSES OF NATURAL GASES, 1974 Information Circular
B. J. Moore Sep. 1974 128 p
(PB-245907/1; BM-IC-8684) Avail: NTIS HC $6.00 CSCL 21D

This publication contains analyses and related source data for 352 natural gas samples from wells and pipelines in 18 States and 5 foreign countries. All samples were obtained and analyzed during Calendar Year 1974 as a part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economics. GRA

N76-20617# Federal Energy Administration, Washington, D.C.
OIL AND GAS RESOURCES, RESERVES, AND PRODUCTIVE CAPACITIES, VOLUME 1 Final Report
Oct. 1975 74 p
(PB-246354/5; FEA/G-75/618) Avail: NTIS HC $4.50 CSCL 08I

Reserve and productive capacity estimates are given and compared with estimates from other sources. A U.S. crude oil productive capacity estimate is provided. The procedures used to develop these estimates, are evaluated. GRA

N76-20618# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
AIRBORNE INFRARED IMAGERY OF ARCTIC SEA ICE THICKNESS
P. M. Kuhn, L. P. Sterns, and R. O. Ramjeier May 1975 23 p refs
(PB-246426/1; NOAA-TR-ERL-331; NOAA-75101401) Avail: NTIS HC $3.50 CSCL 08L

An empirically observed correlation between ice thickness and infrared brightness ice temperature, based on heat transfer and heat flux at the sea-ice and sea-air interfaces is presented. GRA

N76-20619# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
AN EVALUATION OF THE USE OF THE EARTH RESOURCES TECHNOLOGY SATELLITE FOR OBSERVING OCEAN CURRENT BOUNDARIES IN THE GULF STREAM SYSTEM
George A. Maul Jan. 1975 130 p
(PB-246932/8; NOAA-TR-ERL-335; AOML-18; NOAA-75101402) Avail: NTIS HC $6.00 CSCL 08C

Remote sensing of ocean color to locate current boundaries was tested in the eastern Gulf of Mexico. A 1-year time history of the Gulf Loop Current was made by a ship in synchronization with the Earth Resources Technology Satellite (ERTS). Surface chlorophyll-a, temperature, and scattering observations show that color signature of the current is present when thermal indications are absent, and thus this flow can potentially be monitored by a combination of visible and infrared techniques. GRA

N76-20620# Geological Survey, Reston, Va.
DEVELOPMENT AND APPLICATION OF REMOTE-SENSING TECHNIQUES IN THE SEARCH FOR DEPOSITS OF COPPER AND OTHER METALS IN HEAVILY VEGETATED AREAS, STATUS REPORT 1 JUNE 1975 Project Report for Jan. - Jun. 1975
Frank C. Canney 1975 45 p
(Grant PASA-TA(IC)-05-73)
(PB-246284/4; USGS-GD-75-020; IR-NC-48) Avail: NTIS HC $4.00 CSCL 08G

Experiments in the use of visual photointerpretation of multiband photography to detect changes in vegetation caused by abnormal concentrations of metals in soil are described. Cooperative efforts are being made to study areas in Brazil, Philippines, and Thailand. GRA

N76-20621# Montana State Univ., Bozeman. Water Resources Research Center.
APPLICATION OF MICROWAVE WATER SENSING TECHNIQUES TO WATERSHEDS
Bruce R. McLeod Jul. 1975 40 p refs
(PB-246196/0; MUJWRRC-67; W76-00675; OWRT-A-079-MONT(1)) Avail: NTIS HC $4.00 CSCL 08H

The feasibility of applying microwave moisture sensing techniques to the area of watershed management is discussed. A portable, field-usable microwave moisture meter was developed to give rapid, accurate moisture information on such forest fuels as litter, duff, and dead sticks. The project also produced a second type of meter using the same principle of microwave moisture sensing. This instrument monitors, on a real time basis, changes in forest fuel moisture content in response to changes in external stimuli such as humidity changes. Preliminary results show very rapid changes in moisture content for litter. GRA

N76-20622# Vanderbilt Univ., Nashville, Tenn.
EVALUATION OF MATHEMATICAL MODELS FOR TEMPERATURE PREDICTION IN DEEP RESERVOIRS
Frank L. Parker, Barry A. Benedict, and Chii-ell Tsai Jun. 1975 227 p refs
(Grant EPA-R-800613)
(PB-246576/3; EPA-660/3-75-038) Avail: NTIS HC $8.00 CSCL 13B

Among the models evaluated, the MIT deep reservoir model appears to be most easily used and to give results most compatible with the measured temperatures. The temperature predicted is strongly dependent upon the magnitude of the absorption coefficient of water, and the diffusion coefficient. A sensitivity analysis showed that an absorption coefficient of about 0.75/m and a diffusion coefficient of 15 to 20 times molecular diffusion are appropriate choices for seven TVA reservoirs that were studied. The determination of whether or not a reservoir model depends on the Densimetric Froude number. By the use of a fitted curve to the measured temperatures, it was possible to determine the maximum standard error of estimate for the predicted outlet level temperature. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-20623 Montana State Univ., Missoula.
A SIMULATION APPROACH TO A MAGNETOHYDRODYNAMIC-STEAM ELECTRICAL POWER GENERATION SYSTEM Ph.D. Thesis
Teodoro Canillas Robles 1975 213 p
Avail: Univ. Microfilms Order No. 76-4874

A mathematical model of a magnetohydrodynamic-steam electric power generation system was developed, incorporating the results of experimental and theoretical investigations which are applicable to large electrical power generation. A real gas at subsonic condition was used in the flow calculation. A quasi one-dimensional MHD generator model was used to explore the advantages of the model in the design of the control mechanisms for the system. The behavior of the MHD generator in response to load changes is discussed. The dynamic model of the dc to ac converter is presented and the design parameters compatible with the MHD generator operation are discussed. A dynamic model of the steam plant and air heaters was developed; the results of the simulation of the model in response to changes in input conditions are shown. The design parameters of the steam plant for a 2,000 megawatt (thermal input) MHD system are given. Dissert. Abstr.

N76-20624*+ National Aeronautics and Space Administration, Washington, D.C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 7, DECEMBER 1975
Dec. 1975 342 p refs
(NASA-SP-7043(07)) Avail: NTIS HC $4.00 CSCL 10B

This bibliography lists 540 reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1975 through September 30, 1975. Author

N76-20625*+ New Mexico Univ., Albuquerque. Technology Application Center.
HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS. ANNUAL SUPPLEMENT, 1974
Mani Natarajan, ed 1975 236 p Sponsored by NASA
(NASA-CR-146791; TAC-H-74-501) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC $22.50 CSCL 10B

A bibliography with abstracts on research and projections on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. References identified during the year 1974 are cited. Cross indexes are included. Topics covered include: production; utilization; transmission, distribution, and storage; and safety. J.M.S.

N76-20626*+ New Mexico Univ., Albuquerque. Technology Application Center.
QUARTERLY LITERATURE REVIEW OF HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS. FIRST QUARTER, 1975 Quarterly Update, 31 Mar. 1975
1975 57 p Sponsored by NASA
(NASA-CR-146789) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC available by subscription only HC $48.00 CSCL 10B

A continuing bibliographic summary with abstracts of research and projection on the subject of hydrogen as a secondary fuel and as an energy carrier is presented. Cross indexes are included. Topics covered include production, utilization, and safety. J.M.S.

N76-20627*+ New Mexico Univ., Albuquerque. Technology Application Center.
QUARTERLY LITERATURE REVIEW OF HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS. SECOND QUARTER, 1975 Quarterly Update, 30 Jun. 1975
1975 44 p Sponsored by NASA
(NASA-CR-146790) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC available by subscription only $50.00 CSCL 10B

For abstract, see N76-20626.

N76-20628*+ New Mexico Univ., Albuquerque. Technology Application Center.
QUARTERLY LITERATURE REVIEW OF HYDROGEN ENERGY: A BIBLIOGRAPHY WITH ABSTRACTS. THIRD QUARTER, 1975 Quarterly Update, 30 Sep. 1975
1976 107 p Sponsored by NASA
(NASA-CR-146779; QR-3) Avail: NTIS for foreign requesters only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque HC available by subscription only $50.00 CSCL 10B

For abstract see, N76-20626.

N76-20629*# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
A NEW WIND ENERGY CONVERSION SYSTEM
Frederick O. Smetana 1 Nov. 1975 16 p
(Contract NASw-2721)
(NASA-CR-146539) Avail: NTIS HC $3.50 CSCL 10A

It is presupposed that vertical axis wind energy machines will be superior to horizontal axis machines on a power output/cost basis and the design of a new wind energy machine is presented. The design employs conical cones with sharp lips and smooth surfaces to promote maximum drag and minimize skin friction. The cones are mounted on a vertical axis in such a way as to assist torque development. Storing wind energy as compressed air is thought to be optimal and reasons are: (1) the efficiency of compression is fairly high compared to the conversion of mechanical energy to electrical energy in storage batteries; (2) the release of stored energy through an air motor has high efficiency; and (3) design, construction, and maintenance of an all-mechanical system is usually simpler than for a mechanical to electrical conversion system. L.S.

N76-20630# Committee on Aeronautical and Space Sciences (U. S. Senate).
ENERGY-RELATED RESEARCH AND DEVELOPMENT
Washington GPO Apr. 1975 137 p Rept. for Comm. on Aeron. and Space Sci., 94th Congr., 1st Sess., Apr. 1975
(GPO-51-189) Avail: SOD HC $1.55

An update is presented of the report on energy-related research and development being conducted within the NASA. The various projects in energy research and development are discussed, with emphasis on solar and nuclear energy. Possibilities of energy conversion, transmission and storage are presented with views of eventual application to transportation propulsion systems. Priority is given to energy and environment conservation in regard to fuel consumption and inefficient energy systems. Finally, relevant space and nuclear research is studied and the solutions to the energy problems is thought to rely heavily on the technology derived from these two sources. L.S.

N76-20631*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARATIVE EVALUATION OF PHASE 1 RESULTS FROM THE ENERGY CONVERSION ALTERNATIVES STUDY (ECAS)
Feb. 1976 375 p refs Sponsored in part by ERDA and NSF
(NASA-TM-X-71855; E-8596) Avail: NTIS HC $10.50 CSCL 10A

Ten advanced energy conversion systems for central-station, based-load electric power generation using coal and coal-derived fuels which were studied by NASA are presented. Various contractors were selected by competitive bidding to study these systems. A comparative evaluation is provided of the contractor results on both a system-by-system and an overall basis. Ground rules specified by NASA, such as coal specifications, fuel costs, labor costs, method of cost comparison, escalation and interest during construction, fixed charges, emission standards, and environmental conditions, are presented. Each system discussion includes the potential advantages of the system, the scope of each contractor's analysis, typical schematics of systems, comparison of cost of electricity and efficiency for each contractor, identification and reconciliation of differences, identification of future improvements, and discussion of outside comments. Considerations common to all systems, such as materials and furnaces, are also discussed. Results of selected in-house analyses are presented, in addition to contractor data. The results for all systems are then compared. Author

N76-20632*# AiResearch Mfg. Co., Torrance, Calif.
DEVELOPMENT OF A SOLAR-POWERED RESIDENTIAL AIR CONDITIONER Final Summary Report
28 Nov. 1975 146 p
(Contract NAS8-30758)
(NASA-CR-144234) Avail: NTIS HC $6.00 CSCL 10A

The initial objective of the program was the optimization (in terms of cost and performance) of a Rankine cycle mechanical refrigeration system which utilizes thermal energy from a flat solar collector for air conditioning residential buildings. However, feasibility investigations of the adsorption process revealed that a dessicant-type air conditioner offers many significant advantages. As a result, limited efforts were expended toward the optimization of such a system. D.M.L.

N76-20633*# Spectrolab, Inc., Sylmar, Calif.
LOW COST SILICON SOLAR CELL ARRAY Final Technical Report
F. T. C. Bartels Sep. 1974 95 p refs
(Contract NAS3-17361)
(NASA-CR-134743; Rept-3788-FR) Avail: NTIS HC $5.00 CSCL 10A

The technological options available for producing low cost silicon solar cell arrays were examined. A project value of approximately $250/sq m and $2/watt is projected, based on mass production capacity demand. Recommendations are included for the most promising cost reduction options. Author

N76-20634*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANICAL CAPACITOR
James A. Kirk, Philip A. Studer, and Harold E. Evans Washington Mar. 1976 61 p refs
(NASA-TN-D-8185; G-7639) Avail: NTIS HC $4.50 CSCL 10C

A new energy storage system (the mechanical capacitor), using a spokeless magnetically levitated composite ring rotor, is described and design formulas for sizing the components are presented. This new system is configured around a permanent magnet (flux biased) suspension which has active servo control in the radial direction and passive control in the axial direction. The storage ring is used as a moving rotor and electronic commutation of the stationary armature coils is proposed. There is no mechanical contact with the rotating spokeless ring; therefore, long life and near zero rundown losses are projected. A 7-kW h system is sized to demonstrate feasibility. A literature review of flywheel energy storage systems is also presented and general formulas are developed for comparing rotor geometries. Author

N76-20635# Bureau of Mines, Washington, D.C.
UNITED STATES ENERGY THROUGH THE YEAR 2000, REVISED
Walter G. Dupree, Jr. and John S. Corsentino Dec. 1975 73 p Revised
Avail: NTIS HC $4.50

A forecast of future energy consumption and supply is presented. The forecast is based on the evaluation of Bureau of Mines fuels data and the assumption that existing patterns of resource utilization will continue. It is suggested that projected energy resource utilization patterns can be altered to take advantage of the more plentiful indigenous resources. Author

N76-20636# Committee on Commerce (U. S. Senate).
INDUSTRY EFFORTS IN ENERGY CONSERVATION
Washington GPO 1974 290 p refs Prepared for Comm. on Commerce, 93d Congr., 2d Sess., Oct. 1974
(GPO-35-814) Avail: SOD HC $3.50

A survey was conducted of the nation's 100 largest industrial corporations to gain information on the measures they have taken to reduce energy waste and to improve the efficiency of energy utilization in their operations. Of those surveyed, 87 companies replied. All reported the establishment of some form of energy conservation program. Many indicated that they had initiated energy economy programs even before the seriousness of the energy crisis became widely known. Several of the companies also noted that energy conservation is not only a fulfillment of corporate responsibility, but also sound business practice. In some cases, overall energy savings of up to 26% were reported. Summaries and selected examples of the various ways industrial executives assemble energy data, coordinate energy policies, and the results of these efforts are presented. This analysis of the responses is divided according to specific areas of corporate energy conservation programs. The full texts of many of the responses are included. Author

N76-20637# Committee on Finance (U. S. Senate).
FISCAL POLICY AND THE ENERGY CRISIS, PART 4
Washington GPO 1974 579 p refs Hearings on S. 2806 before Subcomm. on Energy of Comm. on Finance, 93d Congr., 2d Sess., 27-29 Nov.; 23-25, 28 and 29 Jan. 1974
(GPO-28-243) Avail: SOD HC $4.45

Testimony and reports regarding energy policy and various energy sources are presented. Nuclear energy, coal, petroleum,

solar energy, and windpower are discussed. Economic, technological, and environmental factors are considered. D.M.L.

N76-20638# RAND Corp., Santa Monica, Calif.
ENERGY ALTERNATIVES FOR CALIFORNIA: PATHS TO THE FUTURE
William Ahern, Ronald Doctor, William Harris, Albert Lipson, Deane Morris, and Richard Nehring Dec. 1975 331 p refs Sponsored in part by Calif. State Assembly and Rockefeller Foundation
(R-1793-CSA/RF) Avail: NTIS HC $10.00

Major energy issues affecting California were studied. Considerable emphasis was placed on developing a coordinated state policy response which is harmonious with national interests. A description of past and future energy sources is first presented and uses of energy in California are discussed. Several energy supply issues are then addressed: West-East oil movement, offshore oil and gas development, a northern California deepwater port, liquefied natural gas, gas transportation from the North Slope of Alaska, natural gas regulation, and allocation policies, electricity generation, and the development of alternative energy sources. Energy conservation measures are also examined in the transportation residential, commercial, and industrial sectors. Different scenarios of California's energy future, each of which incorporates a different set of policy actions, are discussed and various institutional alternatives for formulating and implementing state energy policy are examined. Author

N76-20639# RAND Corp., Santa Monica, Calif.
ENERGY ALTERNATIVES FOR CALIFORNIA: PATHS TO THE FUTURE, EXECUTIVE SUMMARY
William Ahern, Ronald Doctor, William Harris, Albert Lipson, Deane Morris, and Richard Nehring Dec. 1975 44 p ref Sponsored in part by Calif. State Assembly and Rockefeller Foundation
(R-1793/1-CSA/RF) Avail: NTIS HC $4.00

The major results of a project to identify and analyze energy policy issues facing the Sate of California are presented. Author

N76-20640# Federal Energy Administration, Washington, D.C. Office of Environmental Regulations.
AN ANALYSIS OF THE IMPACT ON THE ELECTRIC UTILITY INDUSTRY OF ALTERNATIVE APPROACHES TO SIGNIFICANT DETERIORATION. VOLUME 1: EXECUTIVE SUMMARY
Oct. 1975 53 p refs Prepared in cooperation with EPA, Washington, D. C.
(PB-246205/9; FEA/D-75/585-Vol-1) Avail: NTIS HC $4.50 CSCL 10B

This report evaluates the impact of proposed Senate, House, and EPA regulations regarding significant deterioration of air quality on the electric utility industry. The following issues are evaluated: (1) aggregate impact of significant deterioration requirements on new coal-fired power plants, (2) implications of Class I area designations, (3) impact of alternative Class II increments, (4) implications of stack height limitations; and (5) minimum degree of emission control. GRA

N76-20641*# Solarex Corp., Rockville, Md.
DEVELOPMENT OF A HIGH EFFICIENCY THIN SILICON SOLAR CELL Quarterly Report
Joseph Lindmayer Mar. 1976 22 p Prepared for JPL
(Contracts NAS7-100; JPL-954290)
(NASA-CR-146770; SX/105/2Q; QR-2) Avail: NTIS HC $3.50 CSCL 10A

One hundred thin (120 microns to 260 microns) silicon-aluminum solar cells were fabricated and tested. Silicon slices were prepared, into which an aluminum alloy was evaporated over a range of temperatures and times. Antireflection coatings of tantalum oxide were applied to the cells. Reflectance of the silicon-aluminum interfaces was correlated to alloy temperature (graphs are shown). Optical measurements of the rear surface-internal reflectance of the cells were performed using a Beckman spectrophotometer. An improved gridline pattern was evaluated and stability tests (thermal cycling tests) were performed. Results show that: (1) a high-index, high-transmittance antireflection coating was obtained; (2) the improved metallization of the cells gave a 60 percent rear surface-internal reflectance, and the cells displayed excellent fill factors and blue response of the spectrum; (3) an improved gridline pattern (5 micron linewidths compared to 13 micron linewidths) resulted in a 1.3 percent improvement in short circuit currents; and (4) the stability tests showed no change in cell properties. J.R.T.

N76-20642# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Section Aerospatiale.
SERVICE LIFE OF Ag-Cd BATTERIES ON GEOSTATIONARY ORBIT Final Report [DETERMINATION DE LA DUREE DE VIE DES ACCUMULATERUS ARGENT-CADMIUM EN ORBITE GEOSTATIONNAIRE]
J. Goualard Oct. 1975 125 p In FRENCH
(Contract ESTEC-1816/72-HP)
(DT/SAS-561/74-JG/JM; ESA-CR(P)-783) Avail: NTIS HC $5.50

Types Ag-Cd 5S SAFT and YS 10S YARDNEY batteries were examined and cycled in normal and accelerated tests. Results for cycling tests during a 2-year period show that the service life must be expressed in number of days instead of cycles, and the previous storage period should be taken into account. The maximum life of the Ag-Cd 5S battery varies from 400 to 900 days for discharge depths from 66 to 30 %. The maximum operating temperature is 0 C. The most favorable storage conditions are 0 C temperature and open circuit. A detailed failure analysis was carried out. ESA

N76-20643# Societe des Accumulateurs Fixes et de Traction, Romainville (France). Section Aerospatiale.
EVALUATION OF A NICKEL-HYDROGEN BATTERY FOR SPACE APPLICATION Final Report [EVALUATION D'UN ACCUMULATEUR NICKEL-HYDROGENE A USAGE SPATIAL]
J. M. Billard and D. Dupont Oct. 1975 106 p In FRENCH
(Contract ESTEC-2345/74-HP)
(DT/SAS-674/75-JMB/JM; ESA-CR(P)-784) Avail: NTIS HC $5.50

Results of electrical space qualification tests of a nickel-hydrogen battery type HR 23S are presented. The results obtained are similar to those obtained for the nickel-cadmium battery type VO 23S, except that the voltage level and the charge conservation characteristics vary significantly. The electrical and thermal characteristics permit predictions of the following optimal applications: charge coefficient in the order of 1.3 to 1.4 at 20 C; charge current density higher than C/10 at 20 C; discharge current density from C/10 to C/3 at 20 C; maximum discharge temperature: 0 C; storage temperature: -20 C. ESA

N76-20644# Metropolitan Washington Council of Governments, D.C.
ENERGY BALANCE FOR THE WASHINGTON METROPOLITAN AREA FOR 1973 Final Report
P. Graham, T. Markle, V. Krouse, and R. Haas Jun. 1975 48 p refs
(Grant HUD-CPA-DC-1011)
(PB-245391/8) Avail: NTIS HC $4.00 CSCL 21D

A framework of accounts used in the metropolitan energy balance is presented for each of the following headings: resource type, fuel type, method of conversion, energy use, and demand sector. A table by fuel type of non-renewable and renewable primary energy resources used in the metropolitan Washington area is presented. Energy use data are presented in three demand sectors: (1) commercial, industrial, and institutional, (2) residential, and (3) transportation. Energy use data are presented by fuel type and demand sector using the following accounts: space heat, water heat, air conditioning, process, ground passenger transportation, ground freight transportation and air transportation. A flow chart is presented showing how metropolitan energy resources model is integrated into a metropolitan framework model used for forecasting the effects of alternative metropolitan management strategies over a specified planning period. GRA

N76-20645# California State Div. of Oil and Gas, Sacramento.
PROCEEDINGS OF THE WORKSHOP ON ENVIRONMENTAL ASPECTS OF GEOTHERMAL RESOURCES DEVELOPMENT
David N. Anderson and Richard G. Bowen Nov. 1974 115 p refs Prepared jointly with Oregon State Dept. of Geol. and Mineral Ind.
(Contract NSF AER-75-06872)
(PB-245209/2; NSF/RA/E-74-071) Avail: NTIS HC $5.50 CSCL 10A

Environmental degradation related to the use of geothermal resources to produce electricity and directions for research to mitigate these problems are discussed. Six work groups were established: Water Quality, Air Quality, Biological Impact, Hazards, Environmental Impact Evaluation, and Land use and Socio-Economic Impact. A chairman's summary, problems and recommended approaches to solution are presented in each area. GRA

N76-20646# Dow Chemical Co., Midland, Mich.
EVALUATION OF NEW ENERGY SOURCES FOR PROCESS HEAT Final Report
G. L. Decker, R. W. Barnes, Robert E. Sampson, and Virginia L. Prentice Sep. 1975 242 p refs Prepared in cooperation with Environmental Research Inst. of Michigan
(Grant NSF OEP-74-18055)
(PB-245604/4; NSF/OEP-74-18055-1) Avail: NTIS CSCL 21D

The technological and economical feasibility is discussed of several alternative energy sources as replacements for oil and gas in the production of industrial process heat. Current industrial fuel usage patterns are described quantitatively and classified into categories relevant to potential replacement by the alternate energy sources. The alternate sources are characterized at their current and near term expected state of development. For those energy sources having a technological capability to replace industrial oil or gas in significant quantity, the comparative economics of use are evaluated for the present and future points in time. For those sources which are or may become both economically and technologically competitive with oil and gas, primary research and development needs are identified. GRA

N76-20647# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
ADVANCED COAL-DERIVED FUEL COMBINED-CYCLE POWER PLANTS
Sep. 1975 226 p refs Sponsored by the Commonwealth of Kentucky Prepared jointly with Westinghouse Elec. Corp.
(PB-246202/6; IMMR2-PD2-75) Avail: NTIS HC $8.00 CSCL 10B

The utilization of high-sulfur caking coals typical of Western Kentucky for electric power generation at high efficiencies is considered. Various power systems are evaluated against these objectives consistent with environmental considerations and economic criteria. GRA

N76-20648# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
VOLATILE MATTER RELEASED FROM COALS Interim Report
Francis M. Wachi and Donald E. Gilmartin 30 Sep. 1975 22 p refs
(Contract F04701-75-C-0076)
(AD-A016531; SAMSO-TR-75-233; TR-0076(6950-07)-3) Avail: NTIS CSCL 21/4

The degassing behavior of St. Nicholas anthracite has been investigated at 25 - 1400 C in vacuum. Relevant data have been obtained that could help provide a more complete understanding of the decrepitation phenomenon that precludes the use of anthracites as metallurgical fuel. GRA

N76-20649# National Conference of State Legislatures, Washington, D.C.
ENERGY: THE STATES' RESPONSE: ENERGY LEGISLATION JANUARY - JULY 1975, VOLUME 1
R. G. Jones and Joette Pelster Aug. 1975 517 p refs
(Contract DI-14-01-0001-1832)
(PB-246024/4; FEA/E-75/576-Vol-1) Avail: NTIS HC $12.75 CSCL 05D

This report contains copies of all energy related legislation passed by the 50 State Legislatures during their 1975 sessions. The two volumes of this publication contain 204 bills, totalling 1,107 pages and are a compilation of legislative achievement, vetoed and unsigned bills. Legislation is organized by category. GRA

N76-20650# National Conference of State Legislatures, Washington, D.C.
ENERGY: THE STATES' RESPONSE: ENERGY LEGISLATION JANUARY - JULY, VOLUME 2
R. G. Jones and Joette Pelster Aug. 1975 660 p
(Contract DI-14-01-0001-1832)
(PB-246025/1; FEA/E-75/577-Vol-2) Avail: NTIS HC $16.25 CSCL 05D

Categories in this volume include resource development/facility siting; resource development/revenue; resource development/renewable resources; resource development/financial incentive; resource development/mineral extraction; management; emergency powers/responses; energy/environment; and miscellaneous. GRA

N76-20651# International Research and Technology Corp., Arlington, Va.
END-USES OF PETROLEUM PRODUCTS IN THE U.S., 1965-1975. VOLUME 1: SOURCES, METHODS AND RESULTS Final Report
M. OFarrell and R. W. Roig 20 Oct. 1975 87 p
(Contract DI-14-01-0001-1866)
(PB-246393/3; IRT-391-R-Vol-1; FEA/B-75/656) Avail: NTIS HC $5.00 CSCL 21D

The end-uses of distillate oil, residual oil, aviation jet fuel, and ethane plus propane (combined) were reported in terms of fractional shares of use. The study employs a multilevel structure of detail comprising major categories of end-use, regional uses, and detailed categories of end-use, in that order. Factors taken into consideration include identification by year, petroleum product, major category of end-use, regional area of use, and detailed category of end-use. Volume 1 provides an analysis of each fuel considered by discussing sources, calculations and adjustments, and results. Other topics included are space heating use, manufacturing industry use, electric energy generation use, and transportation use. Data sources for the work included mineral industry surveys, census data, privately compiled data, an IR and T study of the chemical industry, and EPS's National Emissions Data System file. GRA

N76-20652# International Research and Technology Corp., Arlington, Va.
END-USES OF PETROLEUM PRODUCTS IN THE U.S., 1965-1975. VOLUME 2: TABULATIONS OF RESULTS Final Report
M. OFarrell, R. N. Mudry, and R. W. Roig 20 Oct. 1975 166 p
(Contract DI-14-01-0001-1866)
(PB-246394/1; IRT-391-R-Vol-2; FEA/B-75/657) Avail: NTIS HC $6.75 CSCL 21D

The end-uses of distillate oil, residual oil, aviation jet fuel and ethane plus propane (combined) were reported in terms of fractional shares of use. The study employs a multilevel structure of detail comprising major categories of end-use, regional uses, and detailed categories of end-use, in that order. End-use in physical units is obtained by multiplying a control total by a series of factors. These factors are identified by year, petroleum product, major category of end-use, regional area of use, and detailed category of end-use. Volume 2 provides an analysis of each fuel considered by discussing sources, calculations and adjustments, and results. Other topics included are space heating use, manufacturing industry use, electric energy generation use, and transportation use. Data sources for the work included mineral industry surveys, census data, privately compiled data, an IR and T study of the chemical industry, and EPS's National Emissions Data System file. GRA

N76-20653# TRW Systems Group, Redondo Beach, Calif.
OCEAN THERMAL ENERGY CONVERSION RESEARCH ON AN ENGINEERING EVALUATION AND TEST PROGRAM. VOLUME 1: EXECUTIVE SUMMARY Final Report
Jun. 1975 85 p Previously announced as SAN-1089-T1-P1
(Contract NSF C-958)
(PB-246178/8; NSF/RA/N-75-080A-Vol-1) Avail: NTIS HC $5.00 HC also avail. $27.00/set of 5 reports as PB-246177-SET CSCL 10A

Subsystems and components, specifically warm and cold water circulation subsystems and the heat engine subsystem

are evaluated. It was determined that Ocean Thermal Energy Conversion (OTEC) systems are technically feasible, a working fluid can be used in a closed Rankine cycle, driven by the vertical temperature differences available in tropic oceans, to produce net electric power. GRA

N76-20654# TRW Systems Group, Redondo Beach, Calif.
OCEAN THERMAL ENERGY CONVERSION RESEARCH ON AN ENGINEERING EVALUATION AND TEST PROGRAM. VOLUME 2: EVALUATION OF PRIOR WORK, SUBSYSTEMS AND COMPONENTS
Jun. 1975 160 p refs Previously announced as SAN-1089-T1-P2
(Contract NSF C-958)
(PB-246179/6; NSF/RA/N-75-080B-Vol-2) Avail: NTIS HC $6.75 HC also avail. $27.00/set of 5 reports as PB-246177-SET CSCL 10A
For abstract, see N76-20653.

N76-20655# TRW Systems Group, Redondo Beach, Calif.
OCEAN THERMAL ENERGY CONVERSION RESEARCH ON AN ENGINEERING EVALUATION AND TEST PROGRAM. VOLUME 5: APPENDICES
Jun. 1975 346 p refs Previously announced as SAN-1089-T1-P5
(Contract NSF C-958)
(PB-246182/0; NSF/RA/N-75-080E-Vol-5) Avail: NTIS HC $10.00 HC also avail. $27.00/set of 5 reports as PB-246177-SET CSCL 10A
Twelve topics are outlined. They are: (1) annotated bibliography for Ocean Thermal Energy Conversion (OTEC); (2) OTEC power plant components and cost item listing; (3) OTEC preliminary cycle analysis; (4) review of OTEC heat transfer literature and concepts; (5) OTEC turbine sizing; (6) naval architecture and ocean operations; (7) system specification for OTEC power stations; (8) comparison of spar buoy, semi-submersible and surface vessel hull configuration; (9) thermal design of the cold water pipe; (10) mooring and positioning; (11) heat exchanger analysis; and (12) analysis and optimization model description. GRA

N76-20656# Abcor, Inc., Cambridge, Mass. Walden Research Div.
SUMMARY REPORT ON MODELING ANALYSIS OF POWER PLANTS FOR FUEL CONVERSION Final Report
L. Morgenstern May 1975 47 p refs
(Contract EPA-68-02-1377)
(PB-246146/5; EPA-450/3-75-064) Avail: NTIS HC $4.00 CSCL 13B
This report summarizes an air quality modeling analysis of a number of selected power plants. Selected units within specific plants were considered candidates for fuel conversion from oil to coal firing as a result of the oil shortage and energy crisis of 1973-1974. The purpose of this study is to evaluate the impact these candidate conversions would have on ambient sulfur dioxide and particulate concentrations. GRA

N76-20657# Bechtel Corp., San Francisco, Calif.
FEASIBILITY OF SEPARATING CARBON MONOXIDE FROM PRODUCER GAS Final Report, Oct. 1974 - Aug. 1975
R. A. Fisher, M. K. Buder, A. I. Mcone, and M. J. Wong Sep. 1975 141 p
(Contract NSF C-902)
(PB-245653/1; BECHTEL/SDD-75/1; Rept-11299/75-41) Avail: NTIS HC $6.00 CSCL 07A
The report sets forth an evaluation of Tenneco's COSORB processes as it might be applied to coal gasification, considering the production of large amounts of CO for use as a medium-Btu gas. The analysis compares (a) cost of producing pure CO from producer gas with (b) the cost of producing CO/H2 mixture from coal by gasification. In the first case coal is gasified with air, and CO is extracted from the reaction products with COSORB solvent (proprietary). In the second case, the CO/H2 is generated directly by the gasification of coal with oxygen. The study measures the value of the carbon monoxide only in terms of heating value, not in terms of potential value as a chemical feedstock. The costs are developed from analysis of the plants required for production. Three variations of the producer gas plant are considered. The conclusion is that CO produced by extraction from producer gas is at least 50 percent more expensive as a fuel than the CO/H2 mixture. GRA

N76-20658# Illinois Univ., Urbana. Dept. of Civil Engineering.
BIOLOGICAL CONVERSION OF ORGANIC REFUSE TO METHANE Semiannual Progress Report, 1 Jul. - 31 Dec. 1974
John T. Pfeffer and Jon C. Liebman Jan. 1975 136 p refs
(Grant NSF GI-39191)
(PB-245795/0; UILU-ENG-75-2001; NSF/RA/N-75-100) Avail: NTIS HC $6.00 CSCL 07A
This report contains the results of an investigation of refuse fermentation at a thermophilic operating temperature of 60 C. Results of dewatering of the fermentor residue by vacuum filtration and centrifugation are presented. A mathematical simulator of the fermentation process, vacuum filtration process, shedding and separation process, and residue disposal processes were constructed. Results from the simulator runs are presented. GRA

N76-20659# Kentucky Univ., Lexington. Inst. for Mining and Minerals Research.
METHANOL PRODUCTION FROM COAL, SECTION 1
David A. Conner and Gene Plock Aug. 1975 39 p refs Prepared in cooperation with Speed Scientific school
(PB-246201/8; IMMR1-PD1-75-Sect-1) Avail: NTIS HC $4.00 CSCL 07A
As can be noted in the bibliography, many highly competent and well recognized authorities are seriously considering methanol as an energy source of significant magnitude. Most of the studies do not emphasize investment capital, which even at modest implementation of the options noted for methanol's future could range from $10 to $30 billion. The published work which does include investment and product cost estimates is usually optimistic. In the literature, the topical energy spectrum discussed is highly undefined, policy formulation is in the early stages of development, the feedstock phases of energy supplies are defined relations, and capital is considered in the high-risk realm. In spite of this, technology poses a reasonable potential of resolving these interactions. This potential cost and problem resolution, plus the capacity of methanol to supplant a portion of the domestic crude oil, leads to the conclusion that the probability of extensive methanol production from coal as an energy source is high. GRA

N76-20660# Parsons, Brinckerhoff, Quade and Douglas, New York.
ASSURED ENERGY RECEPTIVITY STUDY Final Report
6 Jun. 1975 61 p Sponsored by Transit Develop. Corp.
(PB-246244/8; TDC-AER-75-1) Avail: NTIS HC $4.50 CSCL 10B
The objective of this study is to compare a conventional chopper-controlled train propulsion system without regeneration with two schemes of regeneration: (1) natural receptivity and (2) assured receptivity. A system that employs natural receptivity regeneration converts the kinetic energy of braking trains to electrical energy which is used to power onboard equipment. An assured receptivity regeneration system operates in a manner similar to a natural receptivity system, except that the excess electrical energy is stored, dissipated, or redistributed. The objective of this study is to quantify savings achieved in power consumption and cooling capacity by the use of a regenerative braking system, and compare them to the added costs of the electrical system for both natural and assured energy receptivity. GRA

N76-20661# General Electric Co., Erie, Pa.
ASSURED ENERGY RECEPTIVITY PROGRAM, PHASE 1
Aug. 1975 127 p Sponsored by Transit Develop. Corp.
(PB-246245/5; TDC-AER-75-2) Avail: NTIS HC $6.00 CSCL 10B
Two methods for enhancing the receptivity of a transit system third rail power supply are examined for trains exploying propulsion equipment capable of returning power to the third rail. During periods of heavy traffic, accelerating trains will generally be present to absorb the power made available by braking trains. However, during periods of light traffic, accelerating trains are not likely

to be available on the line and other means must be provided to absorb the braking energy. Two methods for providing such a sink are: (1) addition of resistor banks on the wayside equipped with notching control to match resistance values and line requirements. (2) Addition of dc motor driven flywheel sets on the wayside to absorb the excess braking energy. GRA

N76-20662# Transit Development Corp., Washington, D.C.
ASSURED ENERGY RECEPTIVITY, A PROJECT OVERVIEW Final Report
David R. Phelps Sep. 1975 30 p refs
(PB-246247/1; TDC/500-75/10) Avail: NTIS HC $4.00 CSCL 10B

The technical feasibility of using wayside resistors and two alternative preliminary designs for the mechanization of this concept was investigated. It was verified that wayside resistors for assured electrical receptivity would have a very beneficial effect on ventilating and air-conditioning apparatus for subway stations and tunnels. However, cost-effectiveness analysis showed that in the general case wayside resistors are not cost-effective. Therefore, the feasibility of an alternative wayside system utilizing flywheel motor generator sets (based on state-of-the-art apparatus) for energy storage and reuse was investigated. GRA

N76-20663# Stanford Research Inst., Menlo Park, Calif.
DIRECT USE OF COAL IN A FUEL CELL: FEASIBILITY INVESTIGATION Final Report, 26 Jun. 1974 - 28 Feb. 1975
Robert D. Weaver, Laura Tietz, and Daniel Cubicciotti Jun. 1975 64 p refs
(Contract EPA-68-02-1808)
(PB-245917/0; EPA-650/2-75-040) Avail: NTIS HC $4.50 CSCL 07D

The feasibility of using coal to produce electricity directly in a fuel cell that uses molten-carbonate electrolyte, a coal anode, and an air cathode was studied. The cell voltage, the polarization of the anode, and the nature of the gaseous products formed were investigated. Electrodes made from charred coal yielded open-circuit voltages close to 1 V. At 975 K, the activation plus concentration polarization was about 200 mV at current densities of 100 mA per sq cm and larger. At higher temperatures smaller polarizations were observed. The gaseous anode products were primarily CO2, with some CO. Current efficiencies were somewhat less than 100 percent. The low values were possibly due to losses of anode gases by mechanical means. Coal ash added to the molten electrolyte did not appear to be deleterious to cell operation. Descriptions of possible future engineering systems and thermodynamic limitations are presented. GRA

N76-20664# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
HETEROGENEOUS SENSITIZED DECOMPOSITION OF WATER WITH SUNLIGHT Quarterly Report, 1 Jul. - 30 Sep. 1975
Amal K. Ghosh and H. Paul Maruska 30 Sep. 1975 23 p refs
(Grant NSF ERP-75-13901)
(PB-246172/1; Exxon-GRU-1BEA-75; NSF/RA/N-75-090) Avail: NTIS HC $3.50 CSCL 07E

The goal of the program is to demonstrate that an inexpensive heterogeneous photocatalyst may efficiently decompose water to hydrogen and oxygen (or H2O2) with sunlight. The research is specifically focused on sensitization of known photocatalysts to the sunlight spectrum. The authors demonstrated short circuit photocurrent response in the visible with chromium-doped TiO2 in an electrochemical cell. It was also shown that in an inexpensive manner TiO2 could be easily grown electrochemically. Cu2O was grown by oxidation of copper. Sputtering of Cu2O to make a Cu2O/TiO2 heterojunction is being investigated. GRA

N76-20665# Exxon Research and Engineering Co., Linden, N.J.
EVALUATION OF POLLUTION CONTROL IN FOSSIL FUEL CONVERSION PROCESSES. COAL TREATMENT. SECTION 1: MEYERS PROCESS Final Report
E. M. Magee Sep. 1975 46 p refs
(Contract EPA-68-02-0629)
(PB-246311/5; EPA-650/2-74-009-k) Avail: NTIS HC $4.00 CSCL 08I

The report discusses the Meyers process whereby pyritic sulfur is removed from coal by the action of a solution of ferric sulfate. The coal is not converted, and it essentially retains its original heating value. The pyritic sulfur leaves the process as elemental sulfur and iron sulfates. The quantities of solid, liquid, and gaseous effluents are estimated, as well as the thermal efficiency of the process. For the purpose of reduced environmental impact, a number of possible process modifications or alternatives which could facilitate pollution control or increase thermal efficiency are proposed, and new technology needs noted. GRA

N76-20666# California Univ., San Diego.
IDENTIFICATION OF RESEARCH AND DEVELOPMENT PRIORITIES AND OF COSTING PROBLEMS ASSOCIATED WITH IMPLEMENTATION ON IN SITU RECOVERY OF SHAKE OIL
S. S. Penner Sep. 1974 428 p refs Presented at the UCSD/NSF(RANN) Workshop, San Diego, Calif., 3-7 Sep. 1974
(Contract NSF AER-74-23160)
(PB-246278/6; NSF/RA/N-75-001) Avail: NTIS HC $11.75 CSCL 08I

A workshop on in situ recovery of shale oil was held at the University of California, San Diego, during September 1974. The purpose of the workshop was to identify the critical problem areas impeding the practical development of in situ shale oil recovery techniques. This report emphasizes the special problems relating to the development of in situ technology and identifies the critical research, development, and costing areas. Included are reports from the Fractura Panel, from the Retorting Panel, from the Environmental Impact Panel, and from the Economics Panel. GRA

N76-20667# Boston Univ., Mass. Dept. of Chemistry.
PHOTOCHEMICAL CONVERSION OF SOLAR ENERGY Semiannual Progress Report, 1 Jan. - 30 Jun. 1975
Norman N. Lichtin 31 Jul. 1975 26 p Prepared in cooperation with Exxon Res. and Eng. Co.
(Grant NSF AER-72-03597-A03)
(PB-246156/4; NSF/RANN/SE/A03/75-2; NSF/RA/N-75-088) Avail: NTIS HC $4.00 CSCL 07E

Totally-illuminated multi-thin-layer (TI-MTL) iron-thionine (Fe-TH+) photogalvanic cells were constructed with SnO2 and inSnO2, respectively, as transparent anode and cathode. A .07% sunlight engineering efficiency was achieved with a 4-element cell with 81 micrometer electrode separations. Single element TI-TL SnO2/Pt Fe-TH+ cells were sealed by enclosure and decline in output with time identified as due to leaching of tin from the SnO2 electrode. Reverse-bias experiments indicated that output of the TI-TL SnO2/Pt Fe-TH+ cell is not limited by electrode activation processes. Studies of dependence of cell output on electrode spacing indicate that bulk back reactions are the principle limiting factors. GRA

N76-20668# Lockheed Missiles and Space Co., Palo Alto, Calif.
ADVANCED LITHIUM-WATER BATTERY FOR ELECTRONIC COUNTERMEASURE DEVICES Final Report, 1 Nov. 1973 - 1 Feb. 1975
H. F. Bauman 27 Feb. 1975 80 p
(Contract F33615-73-C-2021)
(AD-A016458; LMSC-D409491; AFAPL-TR-75-39) Avail: NTIS CSCL 10/3

The objective of this effort is to provide advanced battery technology leading to improved primary battery power supplies for Air Force applications. Anode alloys and cathode geometry were evaluated in lithium-water cells. The use of NH4F as a precipitant of LiOH in Li-water cells resulted in constant voltage discharges. Li-H2O cells in breadboard configuration discharged in excess of 45 min. at 1.2 V at 2A/sq in. Li utilization efficiency was greater than 70%. Li cells with H2O2 as cathode reactant delivered 45 min. of discharge at 2.5 V and 2A/sq in. Breadboard batteries discharged at 24 V but at less than design current because of flow equalization problems. GRA

N76-20669# Eagle-Picher Co., Joplin, Mo. Electronics Div.
LOW RATE LITHIUM BATTERIES FOR ECM EXPENDABLES Final Report, 21 May 1973 - 21 Jul. 1975
Robert L. Higgins Jul. 1975 128 p
(Contract F33615-73-C-2061; AF Proj. 3145)

(AD-A016468; AFAPL-TR-75-63) Avail: NTIS CSCL 10/3

This report describes the development and testing of four Li/CF batteries. A 28 volt, 10 ampere-minute battery weighing less than 4 ounces was fully developed, produced and evaluated. The three remaining designs were developed and tested in breadboard configurations. Fully developed batteries were tested at temperatures from -50F to 165F. Results are discussed. GRA

N76-20670# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.

REVIEW OF THE METHODOLOGY FOR STATISTICAL EVALUATION OF REACTOR SAFETY ANALYSES

M. Mazumdar, J. A. Marshall, P. A. Awate, S. C. Chay, and D. K. McLain Sep. 1975 92 p refs Sponsored by Elec. Power Res. Inst.

(PB-246269/5; EPRI-309) Avail: NTIS HC $5.00 CSCL 18I

Nuclear Regulatory Commission regulations require that the performance of the Emergency Core Cooling Systems (ECCS) for nuclear power plants be calculated using evaluation models. These models provide a conservative prediction of the maximum cladding temperature in the event of a design basis accident. The anticipated result will include both an estimate of the most probable or nominal maximum cladding temperature under accident conditions, and an estimate of the probability that the cladding temperature will exceed a given maximum allowable value. This report concerns one aspect of the overall effort-uncertainties through the best estimate code. GRA

N76-20671# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.

STANDARD REVIEW PLAN FOR THE REVIEW OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS. LWR EDITION Interim Report

Sep. 1975 1590 p refs

(PB-247611/7; NUREG-75/087) Avail: NTIS HC $50.75 CSCL 18E

The Standard Review Plan (SRP) describes in detail the safety review that is conducted by the Office of Nuclear Reactor Regulation, U. S. Nuclear Regulatory Commission (NRC) to evaluate applications for licenses for light-water-cooled nuclear power plants. The SRP was prepared by the NRC staff as an internal working document for the purpose of improving the quality and uniformity of staff reviews. The SRP is composed of 224 subsections each of which describes what is reviewed, the basis of review, how it is accomplished and the conclusions that are sought. These plans will have a stabilizing effect on the licensing process that will benefit the public and the nuclear industry. The format of the SRP is consistent with the Revision 2 of Regulatory Guide 1.70, Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants-LWR Edition, which identifies the information needed to evaluate applications for licenses. GRA

N76-20672# Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.

THE ROLE OF FISSION GAS RELEASE IN REACTOR LICENSING. CORE PERFORMANCE BRANCH

Nov. 1975 94 p refs

(PB-247447/6; NUREG-75/077) Avail: NTIS HC $5.00 CSCL 18G

The release of fission gases from oxide pellets to the fuel rod internal voidage (gap) is reviewed with regard to the required safety analysis in reactor licensing. Significant analyzed effects are described, prominent gas release models are reviewed, and various methods used in the licensing process are summarized. A discussion of the state of the art of gas release analysis is presented. GRA

N76-20673# Federal Energy Administration, Washington, D.C. Office of Quantitative Methods.

A COMPARISON OF TWO NATURAL GAS FORECASTING MODELS: TERA AND MACAVOY-PINDYCK

10 Jun. 1975 41 p refs

(PB-246219/0; FEA-EATR-75-15; FEA/B-75/639) Avail: NTIS HC $4.00 CSCL 21D

The supply side of two forecasting models of the natural gas industry, the MacAvoy-Pindyck and the TERA, were each simulated under the same wellhead price scenarios, and the factors causing differences in the forecasts identified. The two scenarios were continued: FPC regulation and phased deregulation. The models produce very different forecasts of the level of potential production. The analysis shows the divergence between the forecasts to be attributed primarily to conservative success ratios in the TERA model which are initialized in 1973 at 3.6%, (only 67% of the 1968-72) and the high success ratios in the other model which are initialized in 1972-73 values but rise to 15-20% values by 1980. GRA

N76-20674# Federal Energy Administration, Washington, D.C. Office of Quantitative Methods.

COMPARISON OF FEA FIGURES WITH INTERIOR COMMITTEE STAFF ANALYSIS OF THE PRESIDENT'S ENERGY PROGRAM

5 Feb. 1975 14 p

(PB-246209/1; FEA-EATR-75-3; FEA/B-75/645) Avail: NTIS HC $3.50 CSCL 21D

Results of an Interior Committee staff study which critiqued President Ford's energy program are compared with FEA figures and the differences in assumptions and methodology of analysis are compared. Both studies agree on the revenues resulting from the program; however, there is substantial disagreement in estimated costs. Major factors supporting the FEA figures are cited and the high estimates in the staff study are attributed to an underestimation of the number of households nationwide, the prediction of windfall profits to natural gas producers, and an overestimation of coal demand and rising coal prices. GRA

N76-20675# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.

THERMIC CONTROLS TO REGULATE SOLAR HEAT FLUX INTO BUILDINGS Semiannual Progress Report, 1 Jan. - 30 Jun. 1975

Shawn Buckley 25 Aug. 1975 50 p refs

(Grant NSF GI-43897)

(PB-246364/4; NSF/RANN/SE/GI-43897/PR-75-2; NSF/RA/N-75-098) Avail: NTIS HC $4.00 CSCL 13A

The purpose of this project was to develop thermic controls for regulating solar heat flux into buildings. Thermics is a control discipline which uses temperature to directly control heat flow. Many independent panels, replacing building walls and roof and controlled internally by thermic devices, would perform three functions: (1) collect solar energy or dissipate internal heat, (2) control the flow of heat into and out of the panel and (3) store heat inside the panel. The panel is to save heating costs in winter by absorbing solar energy and save airconditioning costs in summer by dissipating internal heat at night. A primary objective of the panel was to make its installed unit cost approximately that of conventional walls and roofs. Early research indicated that a switchable thermic diode was the most economic thermic control for use in the panel. GRA

N76-20676# Massachusetts Univ., Amherst.

HYDRODYNAMICS OF GULF STREAM OCEAN THERMAL POWER PLANTS

R. H. Kirchhoff, P. A. Magarella, and J. G. McGowan Sep. 1975 54 p refs Presented at the 1975 Winter Ann. ASME Meeting, Houston, Tex.

(Grant NSF GI-34979)

(PB-246951/8; NSF/RANN/SE/GI-34979/TR-75-10; NSF/RA/N-75-115) Avail: NTIS HC $4.50 CSCL 10B

This report considers the external hydrodynamic aspects of Gulf Stream sited Ocean Thermal Power Plants. Specific details of the ocean resource including flow, temperature, and density profiles are examined for suitability at selected sites. In the light of the most current system design, a semi-submersible 400 Mwe net power plant, the fluid mechanical detail of the interaction of the hot and cold ocean water systems with the total system are studied. GRA

N76-20677# Massachusetts Univ., Amherst. Energy Alternatives Program.

INVESTIGATION OF COMPETITIVE ARRANGEMENTS, 400 MWE OCEAN THERMAL DIFFERENCES POWER PLANT, FOR THE UNITED STATES SOUTHEAST COAST DEVELOPMENT SITE

T. A. L. Poole and William E. Heronemus Jun. 1975 147 p refs
(Grant NSF GI-34979)
(PB-246752/0; NSF/RA/N-75-112) Avail: NTIS HC $6.00 CSCL 10B

This report is a chronicle of 2-1/2 years of evolution of baseline configurations for the ocean thermal differences power plants first proposed by the University of Massachusetts in 1971. It is the work of ocean systems engineers who have dealt more with the spatial interaction and integration of subsystem and components into practical arrangements than with technological details. GRA

N76-20678# Resource Planning Associates, Inc., Cambridge, Mass.
A BRIEF ANALYSIS OF THE IMPACT OF ENVIRONMENTAL LAWS OF ENERGY DEMAND AND SUPPLY
Henri-Claude Bailly, Penny Cushman, and Alex Steinbergh Oct. 1974 130 p refs
(Contract DI-14-01-0001-1628)
(PB-245656/4; RA-74-15; FEA/D-74/568) Avail: NTIS HC $6.00 CSCL 10A

Key environmental issues are identified. The energy impact of each of the issues is quantified and the relative importance of the impacts are evaluated. The 10 selected issues considered are classified in two ways: whether they tend to increase the demand or decrease the availability of energy; and at which point in the energy production/consumption cycle they primarily occur. In defining issues several major Federal enviromental laws are reviewed. Two base years and two forecast years are considered--the base years 1968 and 1973, and the forecast years 1975 and 1980. In evaluation of energy impacts two sets of comparisons is taken into account: the energy impact of each environmental issue was compared with national energy usage in total and by fuel for the relevant two periods; and each issue was compared with nonenvironmental Federal policy impacts. GRA

N76-20679# National Bureau of Standards, Washington, D.C.
PRE-DESIGN ANALYSIS OF ENERGY CONSERVATION OPTIONS FOR A MULTI-STORY DEMONSTRATION OFFICE BUILDING Final Report
Tamami Kusuda, James E. Hill, Stanley T. Liu, James P. Barnett, and John W. Bean Nov. 1975 67 p refs Sponsored in part by Gen. Serv. Admin.
(PB-246689/4; NBS-BSS-78; LC-75-619306) Avail: NTIS HC $4.50 CSCL 13A

The design phase of the GSA-Manchester Building included extensive analysis of the building design and operation to determine the potential for energy conservation. Described in this report are highlights and a summary of the calculations performed during the design phase. The analysis included a study of the exterior shell, ventilation rate, lighting and occupancy levels, room temperature controls, and nighttime flushing of the building using outdoor air, on the predicted yearly energy consumption of the building. GRA

N76-20680# Rutgers Univ., New Brunswick, N.J. Dept. of Electrical Engineering.
SILICON SCHOTTKY PHOTOVOLTAIC DIODES FOR SOLAR ENERGY CONVERSION Quarterly Progress Report, 1 Jun. - 30 Sep. 1975
Wayne A. Anderson Oct. 1975 21 p refs
(Grant NSF AER-73-03197)
(PB-246154/9; NSF/RANN/SE/PR-75-3; NSF/RA/N-75-099) Avail: NTIS HC $3.50 CSCL 10A

A study has been made of many variables involved in Schottky solar cell fabrication. Cr metal and a thin oxide (5-10 A) on the silicon are essential for a high open-circuit voltage. A (100) Si orientation is preferred to (111). Substrate resistivities of 0.2 to 2 ohm-cm produce equivalent solar cells. Various surface-preparation methods and heat-treatment techniques have not produced significant performance trends. Heating the vacuum system prior to evaporation has produced a fill factor of up to 0.75 and more consistent metal film resistance values. An apparent tunneling current component was identified through I-V and activation energy plots. Nb2O5 offers improved antireflection properties compared to SiO. Solar cell resistance seems to be controlled by internal effects at the Schottky barrier interface. GRA

N76-20681# Chicago Univ., Ill. Center for Urban Studies.
ENERGY VERSUS THE ENVIRONMENT: THE ISSUES
Doris B. Holleb and Gary Alexander 1975 35 p Prepared in cooperation with Argonne Natl. Lab., Ill.
(Grants NSF AG-352; NSF GI-32989)
(PB-246382/6; NSF/RA/E-75-045) Avail: NTIS HC $4.00 CSCL 10A

Contents: The supply and costs of petroleum; Alternative energy sources for the future; Correlations between Gross National Product, energy consumption and air pollution; What is energy-related pollution; The importance of conservation measures in dealing with the energy crisis; State and federal impacts of the energy situation; The spatial aspects of pollution; Some perspectives on viewing policy-making and the energy crisis; The effects of the energy crisis on pollution regulation; Dangers of the 'can do' syndrome; Energy and American values. GRA

N76-20682# The Futures Group, Glastonbury, Conn.
A TECHNOLOGY ASSESSMENT OF GEOTHERMAL ENERGY RESOURCE DEVELOPMENT
T. J. Gordon, F. Maslan, and L. Deitch 15 Apr. 1975 563 p refs
(Contract NSF C-836)
(PB-246241/4) Avail: NTIS HC $13.50 CSCL 10A

Some potential uses of geothermal energy in the United States are presented along with a systems evaluation and recommedations for future applications. Specific objectives are to: (1) identify potential constraints to the development of geothermal power; (2) determine feasibility; (3) determine its social, political, economic and environmental impacts in the USA; and (4) provide input to the policy process regarding geothermal energy. GRA

N76-20683# Harvard Univ., Cambridge, Mass.
CONFERENCE ON INTERDEPENDENCE BETWEEN ENERGY AND ECONOMIC GROWTH
Kenneth Arrow, Dale Jorgenson, and Alan Manne 1975 59 p Conf. held in Cambridge, Mass., 4-5 Apr. 1975 Sponsored in part by NSF
(PB-246757/9) Avail: NTIS HC $4.50 CSCL 10A

The conclusions are presented of a conference on the interdependence between energy and economic growth held at Harvard University April 4 and 5, 1975. Research areas discussed were: end use demand for energy, desequilibrium economics and time adjustment, substitution and complementary processes between the energy sector and other sectors of the economy. GRA

N76-20684# Delaware Univ., Newark. Inst. of Energy Conversion.
DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTRIAL USE. THE CdS/Cu2S HETEROJUNCTION IN STEADY STATE
K. W. Boer Oct. 1975 71 p refs Previously announced as NSF/RANN/A03/TR-75-6
(Grant NSF AER-72-03478)
(PB-246710/8; NSF/RANN/AER-72-03478/TR-75-6; NSF/RA/N-75-111; NSF/RANN/A03/TR-75-6) Avail: NTIS HC $4.50 CSCL 10B

The physics of the key processes in the CdS/Cu2S solar cell is discussed. The electron generation and diffusion is analyzed in Cu2S. Collection saturation of electrons from the Cu2S and high-field domains in CdS are proposed to be responsible for current saturation. Proper matching of these is necessary to obtain satisfactory collection efficiencies and characteristics. Matching is achieved by heat treatment yielding sufficient copper doping in the junction region. The boundary conditions at the junction interface are analyzed and provide additional insight into the carrier transport through a heterojunction. The current-voltage characteristics with optical excitation are discussed as being substantially different from the diode characteristic in the dark. GRA

N76-20685# Federal Trade Commission, Washington, D.C.
STAFF REPORT TO THE FEDERAL TRADE COMMISSION

ON FEDERAL ENERGY LAND POLICY: EFFICIENCY, REVENUE, AND COMPETITION
Oct. 1975 970 p refs
(PB-246663/9; FTC-7510003-FELP) Avail: NTIS HC $23.75 CSCL 10A

Past land disposal policies, economic and technological conditions relevant to the choice of a leasing approach, and the general direction and effectiveness of policy for each of the following fuel areas are discussed: offshore oil and gas, onshore oil and gas, oil shale, coal, uranium, and geothermal energy sources. GRA

N76-20686# National Bureau of Standards, Washington, D.C. Center for Building Technology.
NBSLD, COMPUTER PROGRAM FOR HEATING AND COOLING LOADS IN BUILDINGS Final Report
Tamami Kusuda 1 Nov. 1974 412 p refs Submitted for publication Sponsored in part by Housing and Urban Development
(PB-246184/6; NBSIR-74-574) Avail: NTIS HC $11.00 CSCL 13A

A comprehensive computer program called NBSLD, the National Bureau of Standards Load Determination program, has been developed at NBS to reflect the time change of the many building parameters which are pertinent to accurate estimation of energy usage for heating and cooling. Current status of heating and cooling load techniques is reviewed. Of general interest are unique features of NBSLD which are not available in existing computer programs. A summary of various subroutines of NBSLD is given along with the detailed procedures for them. GRA

N76-20687# Alaska Univ., College.
PROCEEDINGS OF THE CONFERENCE WORKSHOP TO REVIEW THE DRAFT STUDY PLAN FOR ENVIRONMENTAL ASSESSMENT OF THE GULF OF ALASKA, SOUTHEASTERN BERING AND BEAUFORT SEAS
Donald H. Rosenberg Apr. 1975 195 p refs
(Contract DI-088550-CT5-24; Grant NOAA-04-5-158-35)
(PB-243873/4; Sea-Grant-75-4) Avail: NTIS HC $7.50 CSCL 10A

Topic areas cover potential oil and gas development in the Arctic offshore and in the Gulf of Alaska, chemical and biological investigations of an oil spill, interests and responsibilities of various federal agencies, state policy regarding outer continental shelf environmental studies, and recommendations for modification to the outer continental shelf environmental study plan. GRA

N76-20688# Dow Chemical Co., Freeport, Tex.
ENERGY CONSUMPTION: FUEL UTILIZATION AND CONSERVATION IN INDUSTRY Final Report, Apr. - Jun. 1975
John T. Reding and Burchard P. Shepherd Sep. 1975 44 p refs
(Contract EPA-68-02-1329)
(PB-246888/2; EPA-650/2-75-032-d) Avail: NTIS HC $4.00 CSCL 10A

Fuel utilization and energy conservation are studied for the six biggest energy consuming industrial groups: chemicals, primary metals, petroleum, paper, stone/clay/glass/concrete, and food. Level of heat rejection and short term effects of various conservation measures are covered. GRA

N76-20689# Resource Planning Associates, Inc., Cambridge, Mass.
ENERGY MANAGEMENT CASE HISTORIES
Oct. 1975 29 p refs
(Contract DI-14-01-0001-1895)
(PB-246763/7; FEA/D-75/335; FEA/D-CP-1B) Avail: NTIS HC $4.00 CSCL 10A

The experiences of four U.S. firms are discussed that have found that the financial benefits of an energy conservation program can be substantial and that such programs are good business management practice. This study illustrates such case experiences. It discusses the way they organized to achieve results, how they implemented their energy saving projects, and the results of their efforts. The analyses go beyond the specific process and business of the company discussed. GRA

N76-20690# Federal Energy Administration, Washington, D.C.
NATIONAL PETROLEUM PRODUCT SUPPLY AND DEMAND. REVISED BASE CASE FORECAST AND THE PRESIDENT'S PROGRAM FORECAST
5 Feb. 1975 41 p ref
(PB-246218/2; FEA-EATR-75-2; FEA/B-75/240) Avail: NTIS HC $4.00 CSCL 10A

Results are presented of implementing the Federal Energy Administration's petroleum supply/demand balance simulation under two sets of assumptions: a base case scenario which documents petroleum product supply and demand using a current macroeconomic simulation and updated price and weather data; and a policy option scenario which incorporates the particulars of the President's energy program into a base case scenario. Appendices present a comparison of alternative forecasts documenting effects of prices and other factors, alternative elasticity estimates, and factors influencing a determination of imported crude oil prices. GRA

N76-20691# Southern California Gas Co., Los Angeles.
SAGE: SOLAR ASSISTED GAS ENERGY
1975 16 p Sponsored by NSF Prepared in cooperation with Calif. Inst. of Tech., Pasadena
(PB-246044/2; NSF/RA/N-75-097) Avail: NTIS HC $3.50 CSCL 13A

SAGE (Solar Assisted Gas Energy) is an evolving system for combining the efficient use of natural gas with solar energy for water and space heating. The objectives of SAGE research are to (1) develop an economical and efficient water heating system that draws its energy from the sun and natural gas; (2) determine the best means of accelerating the consumer use of the system; and (3) enhance conservation of our nation's natural resources. This booklet explains the research program, illustrates the operation of the SAGE system, outlines the history of solar energy, and lists SAGE participants. GRA

N76-20692# Brobeck (William M.) and Associates, Berkeley, Calif.
DEVELOPMENT OF HIGH-DENSITY INERTIAL-ENERGY STORAGE Final Report
H. S. Gordon Jul. 1975 143 p refs Sponsored by Elec. Power Res. Inst.
(PB-245998/0; EPRI-269-1) Avail: NTIS HC $6.00 CSCL 10C

A facility is reported that is capable of testing rotors comprising concentric rings of high strength, fiber matrix composite materials to their ultimate strengths and to start a test program addressed to problems of constructing such rotors. The facility has been designed and built which permits spinning rotors of 200 pounds in weight and up to about 38 inches diameter in vacua of one millitorr and less. Two methods of constructing concentric ring rotor systems have been designed, built and tested. Tests have been made of one-and-two-ring plus hub embodiments of these methods to speeds above 15,000 RPM. No insurmountable difficulties have been encountered. GRA

N76-20693# Federal Energy Administration, Washington, D.C. Office of Quantitative Methods.
IMPACT OF THE PROPOSED ENERGY DEREGULATION/TAX PROGRAM ON SELECTED INDUSTRIES
Apr. 1975 80 p refs
(PB-246207/5; FEA-EATR-75-10; FEA/B-75/647) Avail: NTIS HC $5.00 CSCL 10A

The effects of the energy conservation tax program on baseline fuel prices, fuel consumption by major sectors, and on selected industries are examined. It was determined that the President's proposals would lead to higher fuel prices in 1975. However, the anticipated impact on energy sensitive industries should be less than the impact of the 1973-74 oil embargo. This is based on the assumption that elasticity of demand would be the major factor in determining absorption of, or dollar for dollar pass through of higher fuel costs. Since fuel costs in most industries are small compared to labor and material costs, availability rather than price is the critical factor in the short run. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-20694# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LOS ANGELES HARBOR FIELD INVESTIGATION OF OIL AND BACKGROUND LUMINESCENCE SIGNATURES Final Report
H. Gerald Gross May 1975 121 p refs
(Contract DOT-CG-51998-A)
(AD-A016466; USCG-D-154-75) Avail: NTIS CSCL 13/2

A field investigation of UV laser (pulsed and CW) induced luminescence signatures of site water at five scattered sites in Los Angeles Harbor and one in its principal source of inland inflow, Dominguez Channel, was achieved. The signatures are similar, indicating dominance by one or more common constituents. The peak at about 4,500A and shape of the signature suggest dominance by heavier aromatics, probably by oil and grease, among the principal pollutants. Gas chromatograph-mass spectrometer analyses of site samples show light and heavy constituents, some of which are aromatics. Further work is necessary to relate luminescence signatures to composition. Luminescence signatures of light, medium and heavy oils were established as measurable against the strong water luminescence background. Reflectance signatures of oil films on water indicate a luminescent component due to sky scattered daylight and direct sun UV irradiation. Multispectral photography provided a few examples of site supportive information. GRA

N76-20695# Committee on Science and Technology (U. S. House).
AIRCRAFT NOISE ABATEMENT
Washington GPO 1975 300 p refs Hearings before Subcomm. on Aviation and Transportation R and D of Comm. on Sci. and Technol., 94th Congr., 1st sess., No. 38, 29 Sep.; 1-2 Oct. 1975
(GPO-62-786) Avail: Subcomm. on Aviation and Transporation R and D

Developments in aircraft noise abatement technology are assessed. Topics discussed include: control and identification of aircraft noise sources; the noise path between the aircraft and the observer on the ground; and identification of community noise exposure and psychoacoustic responses. Emphasis is placed on development of future research and development programs dealing with noise abatement technology. J.M.S.

N76-20696*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SURVEY OF INLET NOISE REDUCTION CONCEPTS FOR GAS TURBINE ENGINES
Donald L. Lansing and David Chestnutt Apr. 1976 44 p refs
(NASA-TM-X-72801) Avail: NTIS HC $4.00 CSCL 21E

An overview is given of advanced concepts for the suppression of noise in the inlets of gas turbine engines. Inlet geometric and operating parameters are presented and design criteria for suppression methods are discussed. Noise suppression concepts are described, the directions of current research are reviewed. Problem areas requiring further work are indicated. Well established approaches to inlet noise reduction - namely, acoustic liners and high subsonic Mach number inlets which are the focus of considerable current research activity are considered along with the acoustic absorption and watet vapor injection. Author

N76-20697*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
JPL ACTIVATED CARBON TREATMENT SYSTEM (ACTS) FOR SEWAGE
10 Feb. 1976 49 p refs Presented at Calif. Water Pollution Control Assoc. Northern Regional Conf., Stockton, Calif., 10 Oct. 1975
(Contract NAS7-100)
(NASA-CR-146572; JPL-5040-22) Avail: NTIS HC $4.00 CSCL 13B

An Activated Carbon Treatment System (ACTS) was developed for sewage treatment and is being applied to a one-million gallon per day sewage treatment pilot plant in Orange County California. Activities reported include pyrolysis and activation of carbon-sewage sludge, and activated carbon treatment of sewage to meet ocean discharge standards. The ACTS Sewage treatment operations include carbon-sewage treatment, primary and secondary clarifiers, gravity (multi-media) filter, filter press dewatering, flash drying of carbon-sewage filter cake, and sludge pyrolysis and activation. Tests were conducted on a laboratory scale, 10,000 gallon per day demonstration plant and pilot test equipment. Preliminary economic studies are favorable to the ACTS process relative to activated sludge treatment for a 175,000,000 gallon per day sewage treatment plant. Author

N76-20698*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYDROGEN CHLORIDE MEASUREMENTS FROM TITAN 3 LAUNCHES AT THE AIR FORCE EASTERN TEST RANGE, FLORIDA, 1973 - 1975
Gerald L. Gregory, Dewey E. Wornom, Richard J. Bendura, and H. Scott Wagner Mar. 1976 62 p refs
(NASA-TM-X-72832) Avail: NTIS CSCL 13B

Surface level and in-cloud airborne hydrogen chloride measurements made from Titan 3 launches are summarized. Other data, such as instrument site location and exhaust cloud stabilization and track are also presented. Author

N76-20699*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DIFFUSION ALGORITHMS AND DATA REDUCTION ROUTINE FOR ONSITE REAL-TIME LAUNCH PREDICTIONS FOR THE TRANSPORT OF DELTA-THOR EXHAUST EFFLUENTS
J. Briscoe Stephens Washington Mar. 1976 75 p refs
(NASA-TN-D-8194) Avail: NTIS HC $4.50 CSCL 13B

The National Aeronautics and Space Administration/Marshall Space Flight Center multilayer diffusion algorithms have been specialized for the prediction of the surface impact for the dispersive transport of the exhaust effluents from the launch of a Delta-Thor vehicle. This specialization permits these transport predictions to be made at the launch range in real time so that the effluent monitoring teams can optimize their monitoring grids. Basically, the data reduction routine requires only the meteorology profiles for the thermodynamics and kinematics of the atmosphere as an input. These profiles are graphed along with the resulting exhaust cloud rise history, the centerline concentrations and dosages, and the hydrogen chloride isopleths. Author

N76-20700# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
AIR QUALITY MEASUREMENTS FROM SPACE PLATFORMS
B. Kunkel, F. Wolz, H. J. Bolle (Munich Univ.), and E. Redemann (Munich Univ.) Paris ESA Dec. 1975 341 p refs
(Contract ESRO-SC/70-HQ)
(ESA-CR-577) Avail: NTIS HC $10.00

A survey of the present knowledge of the atmosphere, its composition and structure of the air quality parameters, and the major information gaps is given. The impact of the various air quality parameters on the climate and the environments in general is discussed. Measurement requirements and possible missions are summarized. Present ground measurement techniques for the operational monitoring of air quality near the surface are discussed. A summary of airborne air quality measurements and spaceborne applications and measurement principles, as well as a survey of the various remote sensor types, are given. The present space platforms for air quality measurements as well as the planned spacecraft missions such as Nimbus-G and Spacelab are introduced. The organizational data handling and distribution for an operational air quality system with remote sensing techniques and the likely benefits of such a system are discussed. The main possible users of worldwide distributed data are listed, including the major programs conducted or planned by these user groups. Author (ESA)

N76-20701# California State Dept. of Food and Agriculture, Sacramento. Div. of Plant Industry.
DEVELOPMENT OF A SYSTEM FOR EVALUATING AND

REPORTING ECONOMIC CROP LOSSES CAUSED BY AIR POLLUTION IN CALIFORNIA. 2: YIELD STUDY. 2A: PROTOTYPE OZONE DOSAGE-CROP LOSS CONVERSION FUNCTION Final Report, Jul. 1973 - Jun. 1974

Ronald J. Oshima 30 Jun. 1974 154 p refs
(Contract ARB-2-704)
(PB-245887/5; ARB-R-2-704-74-34) Avail: NTIS HC $6.75 CSCL 02D

A prototype assessment method for determining sweet corn losses from ozone was developed utilizing the functional relationship between crop and ambient ozone dosages. Environmental variables were tested but were not observed to significantly influence sweet corn yield. The procedures for the development of this conversion function could be applied to develop conversion functions for other crops. Fumigation studies compared two different regimes of ozone fumigations and indicated frequent short term exposures had a far greater effect on yield reductions than less frequent exposures of longer duration. Ozone was found to reduce levels of carbohydrates and solids in corn and tomatoes. GRA

N76-20702# Pennsylvania State Univ., University Park. Center for Air Environment Studies.

OXIDATION OF HALOCARBONS Final Report, 1 Jun. 1972 - 31 May 1974

J. P. Keicklen, E. Sanhueza, I. C. Hisatsune, R. K. M. Jayanty, and R. Simonaitis May 1975 153 p refs Presented at Div. of Environ. Chem. Am. Chem. Soc., 169th Natl. Meeting, Philadelphia, 9 Apr. 1975
(Grant EPA-R-800949)
(PB-245153/2; EPA-650/3-75-008) Avail: NTIS HC $6.75 CSCL 07D

The gas-phase room-temperature oxidation of haloethylenes was studied. In general oxidation has been carried out in five ways: (1) chlorine atom initiation, (2) Hg 6(triplet p) sensitization, (3) reaction with O(triplet P), (4) reaction with O(triplet P) in the presence of O2, and (5) reaction with O3. In the first four systems the major products are the corresponding carbonyl chlorides containing 1 or 2 carbon atoms, and the reaction proceeds by a long-chain free radical process. With O3 a diradical chain is involved which is inhibited by O2. Free radical attack of CH2Cl2 or CH3Cl in the presence of O2 gives carbonyl halides, as does the photolysis of CCl4, CCl3F, and CCl2F2 in the presence of O2 or O3. CCl4 and the chlorofluoromethanes react with O(single D) via chlorine atom abstraction in reactions with large rate coefficients which are nearly proportional to the number of chlorine atoms in the chlorofluoromethane. GRA

N76-20703# Abcor, Inc., Cambridge, Mass. Walden Research Div.

SUMMARY REPORT ON MODELING ANALYSIS OF SELECTED POWER PLANTS IN 128 AQCRs FOR EVALUATION OF IMPACT ON AMBIENT SO2 CONCENTRATIONS, VOLUME 1 Final Report

L. Morgenstern Jun. 1975 80 p refs
(Contract EPA-68-02-1484)
(PB-246081/4; EPA-450/3-75-062-Vol-1) Avail: NTIS HC $5.00 CSCL 13B

A summary is presented on a series of 128 reports covering modeling analyses of 195 power plants distributed throughout 60 AQCRs. The purpose of the study is to evaluate the impact on ambient SO2 concentrations of power plant operations. This study provides a base for further analysis if decisions must be made regarding possible compliance extensions or fuel use options for power plants. GRA

N76-20704# Arctec, Inc., Columbia, Md.

TESTS OF OIL RECOVERY DEVICES IN BROKEN ICE FIELDS, PHASE 1 Final Report

L. A. Schulta, P. C. Deslauriers, R. P. Voelker, O. M. Halstad, and D. E. Abrams Jul. 1975 91 p
(Contract DOT-CG-51487-A)
(AD-A016465; USCG-D-130-75) Avail: NTIS CSCL 13/2

This is the final report of full size tests of two oil spill recovery devices, the Lockheed Clean Sweep Model R2003 and the Marco Pollution Control Class I Oil Recovery System, operating in a simulated Arctic environment incorporating below freezing temperatures and ice infested waters. Tests were conducted with both devices in broken fresh water ice and salt water ice, with No. 2 diesel oil and a crude oil selected to closely match the properties of Prudhoe Bay crude oil, at temperatures of -25F and -15F. These tests demonstrated that with minor hardware modifications and the proper operating procedures, both devices will successfully recover crude oil and No. 2 diesel oil spilled in a broken ice field of moderate icepiece size. GRA

N76-20705# Environmental Health Lab., McClellan AFB, Calif.

AN ENVIRONMENTAL EVALUATION OF ACID SCRUBBERS BUILDING 628, MCCLELLAN AFB, CALIFORNIA Final Report

Jerry W. Jackson and William E. Normington Aug. 1975 38 p refs
(AD-A016422; EHL-M-72M-11) Avail: NTIS CSCL 13/2

An environmental evaluation was conducted of an operation in which nitric, perchloric, and hydrochloric acid vapors and aerosols are generated. The evaluation was requested to determine why a visible white plume existed at the exhaust of a wet scrubber. The white plume was formed regardless of meteorological conditions when acid vapors and aerosols were generated. The evaluation included a scrubber efficiency study, an environmental assessment and an air pollution regulation compliance tests. Author (GRA)

N76-20706# Naval Postgraduate School, Monterey, Calif.

ECONOMIC EFFECTS OF ENFORCEMENT VARIABLES ON COMMERCIAL OIL POLLUTION CONTROL STRATEGY M.S. Thesis

Roger Charles Cook Sep. 1975 91 p refs
(AD-A016442) Avail: NTIS CSCL 13/2

An economic decision model for oil pollution control strategy is developed and applied to data taken from the Coast Guard's Pollution Control Incident Reporting System. The model and analysis show the impact of civil penalties, cleanup costs and internal costs on a firm's pollution control strategy. Civil penalties appear to have the largest effect on controlling minor spills, while internal costs become increasingly important to the firm's decision to control larger spills. Notes are included on the PIRS data base and development of an oil spill incident cost model. GRA

N76-20707# Spectrogram Corp., North Haven, Conn.

PETROLEUM OIL DETECTION BUOY SYSTEM Final Report

Herbert R. Gram 31 Mar. 1975 36 p ref
(Contract DOT-CG-43345)
(AD-A016461; USCG-D-39-75) Avail: NTIS CSCL 13/2

Extended capability floating buoy designed to detect petroleum oils ranging in composition from crude to kerosene has been developed and performance tested. This buoy is powered by a land based low voltage direct current power supply at nominally 12 volts. The average total power requirements for the buoy are less than 0.75 watts. The detection system employs fluorescent techniques whereby the oils floating on the water surface are excited by short wavelength ultraviolet radiation and produce, by fluorescence emission, radiation in the near ultraviolet and blue end of the visible spectrum. The fluorescent radiation is selectively detected to produce an alarm condition. Improvements have been made to the mechanical packaging to facilitate deployment and field service. GRA

N76-20708# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

DIRECTORY OF AIR QUALITY MONITORING SITES ACTIVE IN 1973 Annual Report

Mar. 1975 673 p
(PB-246659/7; EPA-450/2-75-006) Avail: NTIS HC $16.25 CSCL 13B

This publication includes a listing of all monitoring sites active in 1973 which have submitted SAROAD Site Identification Form (Figures 1 and 2). Each site to be classified as operation and listed in this directory must have sampled at least one pollutant in 1973. In addition to the site listings, this document reflects useful information on the pollutant sampled. GRA

N76-20709# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
POSITION PAPER ON REGULATION OF ATMOSPHERIC SULFATES Final Report
Sep. 1975 108 p refs
(PB-245760/4; EPA-450/2-75-007) Avail: NTIS HC $5.50 CSCL 13B

Toxicological evidence indicates that certain sulfates, particularly fine particulate acid sulfates, are more potent respiratory irritants than sulfur dioxide alone. Preliminary epidemiological studies suggest that measured sulfates are associated with various health indicators. Sulfates may also be related to damage to the environment by direct deposition or by formation of acid rain. Sulfates in industrialized regions are largely produced by atmospheric reactions of manmade sulfur oxides emissions. Sulfates may be transported long distances from source areas and result in high ambient levels over broad regions. Considerations of chemistry and transport suggest that reductions in regional SO2 emissions would produce reduction in sulfates, although the reductions would be less than one to one. Information concerning sulfates is presented and research and development needs are identified. The implications of the information presented for present and long-term regulatory control of sulfur oxides is also discussed and a policy for sulfates is evaluated. GRA

N76-20710# Combustion Engineering, Inc., Windsor, Conn.
LIME/LIMESTONE SCRUBBING FOR SO2 AND PARTICULATE REMOVAL IN A MARBLE BED SCRUBBER Final Report, 1 Jul. 1971 - 21 Dec. 1972
M. R. Gogineni, K. Malki, and D. C. Borio Jun. 1975 257 p
(Contract EPA-68-02-0221)
(PB-246114/3; EPA-650/2-75-052) Avail: NTIS HC $9.00 CSCL 07A

A prototype marble bed scrubber system was tested for use in power plants. Once-through soluble system tests, using sodium carbonate scrubbing solution, showed that the scrubber is a good liquid/gas contacting device for SO2 removal from flue gases with an overal efficiency of 90 to 95 percent. Liquid/gas ratio and scrubber liquid composition significantly affected SO2 removal; other variables had negligible effect. Limestone furnace injection system tests, using boiler calcined limestone and fly ash, showed that solids concentration in the spray slurry and liquid/gas ratio significantly affected SO2 removal. Limestone tail-end system tests, using limestone in a dual marble bed scrubber showed that the SO2 removal efficiencies of the lower and upper beds are the same. Scale-free operation of both the furnace injection and the tail-end systems can be achieved in a closed loop system, without employing liquid blowdown, by maintining 8 to 10 percent solids in the spray slurry. GRA

N76-20711# GCA Corp., Bedford, Mass. Technology Div.
MOBILE FABRIC FILTER SYSTEM DESIGN AND FIELD TEST RESULTS Final Report, May 1973 - Jan. 1975
Robert R. Hall and Richard Dennis Jul. 1975 137 p refs
(Contract EPA-68-02-1075)
(PB-246287/7; GCA-TR-74-14-G(1); EPA-650/2-75-059) Avail: NTIS HC $6.00 CSCL 07A

The design and operation of a mobile fabric filter system are described, and results are given of a laboratory fabric filter investigation. The mobile system, constructed to study the effects of fabric filtration parameters when filtering an actual industrial effluent stream, was designed for mechanical shake, pulse jet, or reverse flow cleaning. The mobile system was field-tested at a secondary brass boundry, a hot mix asphalt plant, and a coal-fired utility boiler. Woven and felted Nomex and woven glass fabrics were tested. The three cleaning methods were used with appropriate fabrics and emission sources. Pressure drop and efficiency (both mass and particle size) data were collected. Selected aspects of pulse jet and mechanical shake cleaned fabric filters were investigated in the laboratory. The effects of bag fit, pulse supply pressure, and pulse type on filter pressure drop and effluent were investigated. The mechanical shake cleaning tests determined the source of dust emissions for a specific aerosol/fabric combination. Dust emissions resulted from direct penetration, seepage, dust shaken through the filter during cleaning, and dust (loosened during cleaning) that penetrated when air flow resumed. GRA

N76-20712# GCA Corp., Bedford, Mass. Technology Div.
OVERVIEW OF EPA/IERL-RTP SCRUBBER PROGRAMS Final Report
Douglas W. Cooper, Lee W. Parker, and Eugene Mallove Sep. 1975 112 p refs
(Contract EPA-68-02-1316)
(PB-246390/9; GCA-TR-75-22-G; EPA-600/2-75-054) Avail: NTIS HC $5.50 CSCL 07A

An introduction to fine particle control scrubber programs supported by EPA's Industrial Environmental Research Laboratory and topical and chronological overviews of various projects relating to scrubber technology are given. Possible exceptions (mobile-bed scrubbers and series scrubbing with low-energy devices) became objects of further study. Two major mechanisms for increasing scrubber efficiency were studied; flux-force/condensation scrubbing (use of diffusiophoresis and condensation growth of particles), and electrostatic augmentation (scrubbing with charged droplets); both have shown efficiencies which are higher than those achieved by conventional means at equal power consumption levels. Problems with entrained water droplets prompted theoretical and experimantal research in entrainment separator technology, some of the results of which are presented. The hypothesis that particle wettability is important in determining scrubbing efficiency is to be tested by an IERL-RTP sponsored research program. GRA

N76-20713# Midwest Research Inst., Kansas City, Mo.
SAMPLING AND ANALYSIS OF SELECTED TOXIC SUBSTANCES TASK 2, ETHYLENE DIBROMIDE Final Report
John Going and Sue Long Sep. 1975 39 p refs
(Contract EPA-68-01-2646)
(PB-246213/3; EPA-560/6-75-001) Avail: NTIS HC $4.00 CSCL 06T

Ethylene dibromide has recently been reported by the National Cancer Institute to be a potential carcinogen. Its commercial use is predominately as a scavenging agent for lead in gasoline. A minor usage is a pesticide fumigant. A protocol was developed for the sampling and analysis of ethylene dibromide in ambient air and surface water. The range in concentration of ethylene dibromide in the air and the site where it was collected are as follows: manufacturing sites, 4.2 to 115 micrograms per cu m; oil refinery, 0.23-1.65 micrograms per cu m; urban locations near retail gasoline stations and with heavy vehicular traffic, 0.069 to 0.11 micrograms per cu m. Two water samples collected from streams near an oil refinery and a manufacturing site were found to contain 1.13 and 1.05 parts per billion ethylene dibromide, respectively. Further work to clarify ambient air levels and to assess whether they may represent a health risk is anticipated, but the very low levels detected to date are not thought to present a significant risk to health. GRA

N76-20714# National Environmental Research Center, Cincinnati, Ohio. Methods Development and Quality Assurance Research Lab.
VIRUSES IN WASTE, RENOVATED, AND OTHER WATERS. 1974 LITERATURE ABSTRACTS
Gerald Berg and F. Dianne White Jun. 1975 40 p Sponsored by EPA
(PB-245957/6; EPA-670/9-75-007) Avail: NTIS HC $4.00 CSCL 06M

The bibliography contains abstracts of published papers on viruses in water, waste water systems and sewage for 1974. The abstracts cover the detection, removal, and concentration of viruses from various water sources. GRA

N76-20715# Systems Applications, Inc., San Rafael, Calif.
MATHEMATICAL MODELING OF SIMULATED PHOTOCHEMICAL SMOG Final Report, Jun. 1974 - Jun. 1975
Paul A. Durbin, Thomas A. Hecht, and Gary Z. Whitten Jun. 1975 171 p refs
(Contract EPA-68-02-0580)
(PB-246122/6; EF75-62; EPA-650/4-75-026) Avail: NTIS HC $6.75 CSCL 07E

The continued development and testing of a kinetic mechanism for photochemical smog formation is described. Detailed mechanisms containing the individual chemical reactions occurring in irradiated propylene, n-butane, toluene-NOx, and propylene-NOx-SO2 systems were postulated and used to simulate smog

chamber data. A theoretical evaluation was made of the contribution of such chamber effects as light source spectrum decay and surface reactions to the reactivity of the chamber mixture. The application of kinetic simulation to a study of hydrocarbon reactivity and ozone production in smog systems is also discussed. GRA

N76-20716# North Carolina Univ., Chapel Hill. Dept. of Environmental Sciences and Engineering.
OUTDOOR SMOG CHAMBER STUDIES. EFFECT OF HYDROCARBON REDUCTION ON NITROGEN DIOXIDE
Harvey Jeffries, Donald Fox, and Richard Kamens Jun. 1975 223 p refs
(Grant EPA-R-800916)
(PB-245829/7; EPA-650/3-75-011) Avail: NTIS HC $7.75 CSCL 07E

A 312 cu m (11,018 cu ft) Teflon film outdoor smog chamber was constructed in rural North Carolina. The chamber was operated with natural conditions of solar radiation, temperature and relative humidity. Several 12-hour runs using propylene and oxides of nitrogen were conducted to assess the performance of the system. A photochemical model, in which only the light intensity magnitude and pattern and the rate of heterogeneous surface reactions were changed, was used to compare the outdoor results with those of three indoor chambers. Good agreement was found in all cases. Several 12-hours runs were conducted using a simulated urban hydrocarbon mix and oxides of nitrogen. Reduction of the hydrocarbon concentration resulted in reductions of maximum concentration and, for large reductions, the daytime NO2 dosage. Other factors investigated included NO2 to NO ratio at constant NOx, effect of slow dilution, and results of extended 24-hour and 36-hour runs. GRA

N76-20717# National Environmental Research Center, Las Vegas, Nev.
TENTATIVE REFERENCE METHOD FOR THE MEASUREMENT OF GROSS ALPHA AND GROSS BETA RADIOACTIVITIES IN ENVIRONMENTAL WATERS
10 Jun. 1975 23 p refs
(PB-245890/9; EPA-680/4-75-005) Avail: NTIS HC $3.50 CSCL 07E

A tentative reference method for the measurement of gross alpha and gross beta radioactivities in environmental waters is described. Samples of environmental water sources are collected, preserved by acid treatment, and aliquots of the samples are evaporated to dryness in a counting dish and counted for alpha and beta activity. Counting efficiencies for samples aliquots are read from curves prepared from counting data of prepared standards. GRA

N76-20718# McLay (Richard W.), Essex Junction, Vt.
IMPROVING THE STATISTICAL RELIABILITY OF STREAM HEAT ASSIMILATION PREDICTION Final Report
Richard W. McLay, Mahendra S. Hundal, and Kathleen R. Lamborn Jun. 1975 163 p
(Contract EPA-68-03-0439)
(PB-246250/5; EPA-660/3-75-037) Avail: NTIS HC $6.75 CSCL 08H

Mathematical models for predicting heat assimilation in bodies of water are considered. Existing, one-dimensional stream temperature prediction techniques are evaluated for accuracy and precision. The approach is through error estimates on a general model that encompasses all of the models presently used. A sensitivity analysis of this general model is used in conjunction with statistical methods to determine the solution errors. Author

N76-20719# Colorado State Univ., Fort Collins. Environmental Resources Center.
TOXIC HEAVY METALS IN GROUNDWATER OF A PORTION OF THE FRONT RANGE MINERAL BELT
Kenneth W. Edwards and Ronald W. Klusman Jun. 1975 39 p refs
(Contracts DI-14-31-0001-4006; DI-14-31-0001-5006)
(PB-246039/2; Completion-67; W76-00274;
OWRT-A-023-COLO(1)) Avail: NTIS HC $4.00 CSCL 07D

Anodic stripping voltammetry and gas chromatography were investigated with respect to their suitability for multielement analyses of trace elements on natural waters. The elements of interest in toxic and esthetically undesirable elements in the regional ground waters of the Front Range Mineral Belt are arsenic, cadmium, copper, iron, lead, manganese, mercury, selenium, silver, and zinc. Atomic absorption spectrophotometry is commonly used for analysis of these elements but permits only one element to be determined at a time. Anodic stripping voltammetry was highly sensitive and suitable for determination of low concentrations of cadmium, copper, lead, manganese, and mercury. For most of these elements the reproducibility was excellent at the ppb concentration level. Compared with direct flame atomic absorption, this method was more sensitive but not significantly faster despite determination of several elements per analysis. Gas chromatography was investigated for analysis of arsenic, antimony, and selenium by generation and separation of their hydrides. The method was difficult to use effectively and not sufficiently sensitive for natural water analysis. GRA

N76-20720# Calspan Corp., Buffalo, N.Y.
STUDY OF AEROSOL FORMATION IN PHOTOCHEMICAL AIR POLLUTION Annual Report
W. C. Kochmond, D. B. Kittelson, J. Y. Yang, and K. L. Denmerjian Aug. 1975 191 p refs Sponsored by Coordinating Res. Council, Inc.
(Contract EPA-68-01-1231)
(PB-246060/8; CALSPAN-NA-5365-M-2) Avail: NTIS CSCL 07E

Photochemical aerosol production in several SO2 + clean air (filtered air), HC+NO and HC+NO+SO2 systems was examined using the smog chamber approach. The reaction vessels used in this study were the 20,800 cu ft Calspan chamber and the 600 cu ft University of Minnesota chamber. Aerosol formation, growth, and decay mechanisms are described for each of the systems studied. It has been possible in this investigation to characterize system reactivity in terms of aerosol behavior. The most important variables are maximum number concentration, equilibrium surface concentration, and particle volumetric growth rate. Measurements of these variables are made for several systems and are discussed within the text. GRA

N76-20721# Rutgers Univ., New Brunswick, N.J. Dept. of Chemical and Biochemical Engineering.
TREATMENT OF SYNTHETIC URINOUS WASTEWASTER USING COMBINED REVERSE OSMOSIS, IMMOBILIZED UREASE, AND ION EXCHANGE SYSTEMS Final Report
Burton Davidson, Wolf Vieth, Shaw Wang, and Robert Gilmore, Jr. Sep. 1974 153 p refs
(Contract DAAK02-73-C-0094)
(AD-A008947) Avail: NTIS CSCL 07/1

A collagen-urease membrane complex of relatively stable enzymatic activity was successfully produced. In order to evaluate the potential use of this complex for the treatment of urinous wastewater, a biocatalytic reactor module of a novel spiral wound configuration was constructed and integrated into a prototypes system containing reverse osmosis and ion exchange processes. The unit that was designed and constructed was sized so as to be capable of generating sufficient process data that could be used in the estimation of the system design parameters. This work was accomplished by using a synthetic urinous feed solution containing sodium chloride and urea as the major contaminants. The performance of the biocatalytic reactor module was simulated using a transport model consisting of factors which account for simultaneous mass transfer and biochemical reaction. The model was based upon the assumptions of steady-state, plug-flow, and Michaelis-Menten kinetics. From this model, the apparent Michaelis-Menten kinetic parameters were estimated and computer simulated curves were compared to the actual performance data of the biocatalytic reactor module under a variety of reactor feed flow rates and urea concentrations. GRA

N76-20722# National Environmental Research Center, Research Triangle Park, N.C.
HEALTH INTELLIGENCE FOR FUEL AND FUEL ADDITIVE REGISTRATIONS
15 Mar. 1972 44 p
(PB-245790/1) Avail: NTIS HC $4.00 CSCL 06T

The purpose of the task force was to develop a systematic plan to provide health intelligence required under section 211 ('Regulation of Fuels') of the Clean Air Act of 1970, as amended.

It gives the EPA authority to require the conduct of tests 'to determine potential public health effects' of fuels or fuel additives designated for registration and for control. Also to prohibit use of fuels or additives when emission products will endanger the public health or welfare. Through this report, the task force has suggested a program to carry out the above responsibilities.
GRA

N76-20723# Manhattan Coll., New York. Dept. of Chemical Engineering.
SELECTED PROBLEMS IN DESIGN OF AIR POLLUTION CONTROL EQUIPMENT. PART 1: PROBLEM STATEMENTS. PART 2: SOLUTION MANUAL Final Report
Louis Theordore and Joseph Reynolds Aug. 1975 419 p refs (Grant NSF GZ-3432)
(PB-246363/6; MC/CHE-75/01-Pt-1-Pt-2) Avail: NTIS HC $11.00 CSCL 07A

This NSF College Faculty Workshop was concerned with the development of 'Selected Problems in Design of Air Pollution Control Equipment.' Gaseous pollutant control equipment reviewed included: absorption, adsorption condensation, combustion, and dilution. Particulate control equipment topics studied included: fluid-particle dynamics, gravity settlers, cyclones, electrostatic precipitators, venturi scrubbers, and filters. Approximately fifteen problem statements and solutions are presented with each subject.
GRA

N76-20724# GCA Corp., Bedford, Mass. Technology Div.
FRACTIONAL EFFICIENCY OF A UTILITY BOILER BAGHOUSE. NUCLA GENERATING PLANT Final Report
Robert M. Bradway and Reed W. Cass Aug. 1975 148 p ref (Contract EPA-68-02-1438)
(PB-246641/5; GCA-TR-75-17-G(s); EPA-600/2-75-013-a) Avail: NTIS HC $6.00 CSCL 07A

An extensive testing program was performed on a fabric filter baghouse operating on a small coal-fired utility boiler. Total mass loadings were obtained by sampling upstream and downstream using Method 5 techniques; particulate size distributions were obtained with instack impactors. A condensation nuclei counter/diffusion denuder system was also for submicrometer sizing analysis, but the instrumentation was found to be difficult to work with and very sensitive to the static pressure of the sample stream. The results of 22 tests indicated a mean mass efficiency of 99.84 percent. Eleven tests were run at normal baghouse operating conditions and eleven were run at abnormal operating conditions. Statistical analyses show no significant influence of the abnormal operating conditions on particulate penetration.
GRA

N76-20725# Environmental Protection Agency, Washington, D.C. Office of Research and Development.
AN ASSESSMENT OF THE FEDERAL NOISE RESEARCH, DEVELOPMENT AND DEMONSTRATION ACTIVITIES, FY 1973 - FY 1975 Final Report, 1973 - 1975
Eugene E. Berkau, Stephen R. Cordle, Franklin D. Hart, and George R. Simon Jun. 1975 134 p refs
(PB-246894/0; EPA-600/2-75-010) Avail: NTIS HC $6.00 CSCL 20A

The Federal noise research, development, and demonstration (RD&D) activities during fiscal years 1973 through 1975 are examined to determine the contribution of these efforts to the control of environmental noise and to the understanding of the effects of noise. An analysis is made of the research activities in the areas of noise effects, aircraft noise, surface vehicle noise, and machinery noise.
GRA

N76-20726# Army Materiel Command, Texarkana, Tex. Intern Training Center.
AN EVALUATION OF HIGH LEVEL NOISE AND ITS REDUCTION IN A 3,000 BTU/HR GASOLINE-ENGINE-POWERED FIELD REFRIGERATION UNIT Final Report
William C. Brown Apr. 1975 73 p refs
(AD-A009314; USAMC-ITC-02-08-75-403) Avail: NTIS CSCL 13/2

The results are described of research intended to determine the sources of high level airborne noise transmitted from a 3,000 BTU/hr mobile refrigeration unit using an air-cooled engine as the prime mover. An electric motor was adapted to power the unit and the major noise producing components of the system (compressor, motor, fan) were analyzed seperately to determine their contribution to the overall noise. Noise measurements with a sound level meter and octave band analyzer indicated the gasoline engine to be the major source of high level noise. A significant reduction of noise levels was accomplished by addition of sound suppression materials and relocation of the engine exhaust outlet. Design changes which would further reduce engine noise emission are recommended for future procurement of the mobile refrigeration unit.
Author

N76-20727# Army Facilities Engineering Support Agency, Fort Belvoir, Va. Research and Technology Div.
AN ANALYTICAL METHOD FOR DETERMINING HEAT TRANSFER FROM POWER PLANT COOLANT IN THE FLORIDA BOULDER ZONE Final Report
Marcus GreenBerg and Alan J. VanDenBerg Jul. 1974 42 p refs
(DA Proj. 4A0-62119-A-886)
(AD-A010432; RT-2000) Avail: NTIS CSCL 13/2

An analytical solution to the heat transfer problem of dissipating the heat from 83 F power plant coolant to 60 F rock and sea water is described. The problem considers the concept of injecting the coolant into the 'Boulder Zone', the cavernous geological strata underlying all of South Florida, allowing a fresh water bubble to form, and cool for 30 days, before being recirculated back to the plant. The solution revealed that the average temperature of that bubble would be 68.3 F with approximately 37% of the total water discharged at 61 F and 17% at 83 F. The remaining water, or approximately 46% would be a mixture at about 73.5 F.
GRA

N76-20728# PEDCO-Environmental Specialists, Inc., Cincinnati, Ohio.
SURVEY OF FLUE GAS DESULFURIZATION Final Report, Aug. 1974 - Jul. 1975
Gerald A. Isaacs Jul. 1975 75 p ref
(Contract EPA-68-02-1321)
(PB-246285/1; EPA-650/2-75-057-c) Avail: NTIS HC $4.50 CSCL 07A

The report gives results of a survey of the flue gas desulfurization system at Duquesne Light Co.'s 400 MW Phillips Power Station, where four parallel Chemico venturi scrubber trains are installed. In addition to the first stage particulate scrubbers, one of the four trains includes a second stage venturi absorber for the control of SO2 emissions. The system uses slaked lime as the absorbing medium and has been operational since July 1973. An overall SO2 removal efficiency of 50 to 60 percent has been attained. The use of magnesium oxide-modified lime is being investigated in an effort to increase the SO2 removal efficiency of the existing system. Numerous start-up and operational problems have been encountered and corrected. A 10-month evaluation of the system was initiated in December 1974 to determine whether additional SO2 removal equipment will be installed.
GRA

N76-20729# Radian Corp., Austin, Tex.
CONTROL OF HYDROCARBON EMISSIONS FROM PETROLEUM LIQUIDS Final Report, Jul. 1974 - Sep. 1975
C. E. Burklin, E. C. Cavanaugh, J. C. Dickerman, S. R. Fernances, and G. C. Wilkins Sep. 1975 245 p refs
(Contract EPA-68-02-1319)
(PB-246650/6; EPA-600/2-75-042) Avail: NTIS HC $8.00 CSCL 07A

The report is a state of-the-art review of the availability and application of technology for the control of hydrocarbon emissions to the atmosphere from facilities for the production, refining, and marketing of liquid petroleum fuels. The review includes: (1) identification of major hydrocarbon emission sources within the petroleum industry and the quantity of such source emissions, (2) review of existing hydrocarbon emission control technology and the extent of its application by the petroleum industry, and (3) identification of hydrocarbon emission sources within the petroleum industry for which control techniques are neither available nor widely applied.
GRA

N76-20730# Monsanto Research Corp., Dayton, Ohio.
A METHOD FOR EVALUATING SO2 ABATEMENT STRATE-

GIES Final Report, Feb. - Dec. 1974
C. T. Chi, E. C. Eimutis, W. H. Hedley, M. V. Jones, and R. Jones Sep. 1975 83 p refs
(Contract EPA-68-02-1320)
(PB-246669/6; MRC-DA-492; EPA-600/2-75-045) Avail: NTIS HC $5.00 CSCL 07A

A non-deterministic probabilistic method is described that can be used to evaluate sulfur oxides abatement alternatives. The method is not restricted to gas scrubbing models, but can also handle clean fuel substitution processes. The method utilizes a Monte Carlo simulation approach which can treat fully developed cost models and also those which encompass a high level of uncertainty either in structure or in process parameters. The report presents impact assessment techniques which can be used to develop methodology for alternative future scenarios. A specific example, the Wellman-Allied process, is used to demonstrate the utility of simulation methodology. GRA

N76-20731# Rockwell International Corp., Newbury Park, Calif. Air Monitoring Center.
REGIONAL AIR POLLUTION STUDY: THE FORMATION OF SULFURIC ACID IN THE STRATOSPHERE THROUGH THE GAS PHASE OXIDATION OF SO2 Final Report
G. M. Hidy 18 Apr. 1975 105 p refs
(Contract DOT-AS-30074)
(PB-246421/2; SC553.TO11FR; DOT-TST-75-126) Avail: NTIS HC $5.50 CSCL 04A

The results discussed cover a brief review of aircraft and space vehicle emission inventories and the possible perturbation of the stratospheric aerosol. Disturbances resulting from injections of primary particles such as soot and aluminum oxide are considered along with secondary processes, including particulate sulfate formation from sulfur dioxide nitrogen oxide oxidation. Other atmospheric reactions involving organic vapors and hydrochloric acid also are included. GRA

N76-20732# Brown Univ., Providence, R.I. Dept. of Physics.
USE OF ROOM TEMPERATURE DIODES IN MONITORING SPECIFIC GASES Final Report, Jul. 1970 - Jul. 1974
Hendrik Gerritsen, Scott Reuman, Craig Taylor, Everett Crisman, and Jim Beall 31 Jul. 1974 73 p refs
(Grant DI-G-0101740)
(PB-245912/1; BM-OFR-78-75) Avail: NTIS HC $4.50 CSCL 14B

Light emitting diodes of In(delta)Ga(1-delta)As have been prepared which produce room temperature infrared (IR) radiation at the 3.32 micron peak of the methane absorption band. Photovoltaic InAs detectors have also been produced, using similar techniques. The detectors and light emiting diodes have been combined with commercial electronics equipment to produce a system capable of sensing the presence of methane gas at concentrations of 0.1 percent (balance: dry N2). Development has been done on the optics and on balancing the second order effects of water vapor, temperature changes, and dust accumulations which can reach the same magnitude as the signal change produced by 0.5 percent methane. Prototype circuits have been developed and tested. GRA

N76-20733# Southern Research Inst., Birmingham, Ala.
A MATHEMATICAL MODEL OF ELECTROSTATIC PRECIPITATION Final Report
John P. Gooch, Jack R. McDonald, and Sabert Oglesby, Jr. Apr. 1975 162 p refs
(Contract EPA-68-02-0265)
(PB-246188/7; SORI-EAS-75-171; EPA-650/2-75-037) Avail: NTIS HC $6.75 CSCL 13B

A mathematical model is described which relates collection efficiency to electrostatic precipitator (ESP) size and operating parameters. It proposes methods for empirically representing collection efficiency losses caused by non-uniform gas velocity distributions, gas bypassing the electrified regions, and particle reentrainment due to rapping of the collection electrodes. It compares the reduced efficiencies with those obtained from measurements on ESPs treating flue gas from coal-fired generating stations. A procedure for estimating the program output by hand calculation is given, and a complete listing of the FORTRAN computer program is contained in an appendix. GRA

N76-20734# Environmental Protection Agency, Washington, D.C. Oil and Special Materials Control Div.
DISPOSAL OF ORGANOCHLORINE WASTES BY INCINERATION AT SEA Final Report, Oct. 1974 - Jan. 1975
T. A. Wastler, Carolyn K. Offutt, Charles K. Fitzsimmons, and Paul E. Desrosiers Jul. 1975 223 p refs
(PB-245243/0; EPA-430/9-75-014) Avail: NTIS HC $7.75 CSCL 13B

The first officially sanctioned incident of ocean incineration in the United States occurred aboard the M/T Vulcanus in the Gulf of Mexico from October 1974 through January 1975 under an ocean dumping permit issued by the U.S. Environmental Protection Agency for ocean incineration of organochlorine wastes. The report describes the monitoring activities undertaken to evaluate ocean incineration as a disposal method. A total of 16,800 metric tons of waste were incinerated at a maximum rate of 25 metric tons per hour with a 1200 C minimum and a 1350C average flame temperature. Stack gas emissions were mentioned for plume dispersion characteristics and to determine combustion efficiency. The findings indicate that more than 99.9 percent of the wastes were oxidized. Marine monitoring surveys indicate that there were no measurable increases in concentrations of trace metals and organochlorides in the water and marine life. Results of the project indicate that ocean incineration could be a viable alternative of waste disposal which should be considered along with other disposal methods including direct ocean disposal, land disposal, and land incineration. GRA

N76-20735# Commerce Technical Advisory Board, Washington, D.C.
REPORT ON SULFUR OXIDE CONTROL TECHNOLOGY
10 Sep. 1975 89 p
(PB-246667/0) Avail: NTIS HC $5.00 CSCL 13B

This study concerns the urgent need to use coal to generate electricity while meeting the sulfur oxide (SO(x)) emission standards of the Clean Air Act of 1970. It examines how soon, at what cost and with what trade-offs, commercially available SO(x) emission controls can be installed, with arrangements for waste disposal, in all coal-fired generating plants in the Northeastern United States. The study is on the important practical factors affecting the use of SO(x) emission control technologies, including availability, lead times for installation, costs, and gross wastes produced. The aim of the document was to determine the most economic means for attaining continuous emission controls on all coal-fired electricity generating plants in the Northeastern United States at the earliest date possible. GRA

N76-20736# Tennessee Univ., Knoxville. Water Resources Research Center.
A SYSTEMS ANALYSIS OF A CONTINUOUS WATER QUALITY MONITORING PROJECT
Rae E. Cronmiller Aug. 1974 63 p refs
(PB-246846/0; W76-01342; OWRT-A-022-TENN(1)) Avail: NTIS HC $4.50 CSCL 13B

An investigation of the equipment, personnel, installation, and operation of a continuous water quality monitoring project at Fort Loudon Reservoir on the Tennessee River was conducted. The equipment options that were initially considered for the project are discussed in some detail in a state of the arts review. Considered also are some of the most popular system designs currently being employed. The latter part of the study is concerned with a systems analysis of the project. Equipment design and operation are mentioned as the key factors in determining the overall success of a monitoring system. A cost projection of the project for a three-year duration and a comparison of these costs revealed that for a suitable monitoring system yielding reliable data, the operational functions will account for a major portion of the costs incurred. GRA

N76-20737# Environmental Systems Corp., Knoxville, Tenn.
DRIFT DATA ACQUIRED ON MECHANICAL SALT WATER COOLING DEVICES Final Report, Jul. 1973 - Feb. 1975
Gunter O. Schrecker, Ronald O. Webb, David A. Rutherford, and Frederick M. Shofner Jul. 1975 548 p refs
(Contract EPA-68-02-1365)
(PB-246800/7; EPA-650/2-75-060) Avail: NTIS HC $13.00 CSCL 13B

Test data are reported from drift characterization and airborne

salt monitoring studies conducted on and around a single cell, mechanical draft salt water cooling tower and two spray modules at Turkey Point, Florida. Source measurements of drift droplet size distributions and mineral mass emissions were conducted for both devices during a winter test and for the tower alone during a summer test. Atmospheric salt concentrations and depositions were without cooling device operation. Cooling tower drift droplet measurements yielded a drift emission fraction of 0.00027 percent of the water flow rate of 1,260 kg/s, and a droplet mass median diameter of 120 micrometers. GRA

N76-20738# Research Triangle Inst., Research Triangle Park, N.C.
INVESTIGATION OF OZONE AND OZONE PRECURSOR CONCENTRATIONS AT NONURBAN LOCATIONS IN THE EASTERN UNITED STATES. PHASE 2: METEOROLOGICAL ANALYSES Final Report
W. D. Bach, Jr. Feb. 1975 153 p refs
(Contract EPA-68-02-1077)
(PB-246899/9; EPA-450/3-74-034-a) Avail: NTIS HC $6.75 CSCL 13B

The meteorological conditions occurring during measurements of ozone at four nonurban locations in Ohio, Pennsylvania, Maryland and West Virginia are examined for their influence upon the ozone concentrations at the synoptic time and space scale. Air parcel trajectories at the 900 mb level for the forty eight hours prior to arrival at each location were examined for the possible influence of transport across urban industrial areas on the measured nonurban ozone. Time altitude sections of potential temperature and stability from the ground to 5 km at four nearby rawinsonde locations showed that major anomalies in the vertical structure of the lower troposphere are important to the occurrences of high ozone concentrations. GRA

N76-20739# Southeast Environmental Research Lab., Athens, Ga.
ENVIRONMENTAL APPLICATIONS OF ADVANCED INSTRUMENTAL ANALYSIS: ASSISTANCE PROJECTS FY 74
Ann L. Alford Jun. 1975 39 p refs
(PB-247056/5; EPA-660/4-75-004) Avail: NTIS HC $4.00 CSCL 13B

Identified and measured are aquatic pollutants under seven projects in answer to requests for assistance from EPA organizations and other government agencies. In most cases these analyses helped to solve, or at least to understand more clearly, the related pollution incident and in some cases provided evidence for enforcement of regulatory legislation. Under an additional project, analytical consultations were held as requested by various organizations concerned with pollution incidents. GRA

N76-20740# Combustion Engineering, Inc., Windsor, Conn.
PROGRAM FOR REDUCTION OF NOx FROM TANGENTIAL COAL-FIRED BOILERS. PHASE 2A: NOx CONTROL TECHNOLOGY APPLICATION STUDY Final Report, Jul. 1973 - Mar. 1975
Ambrose P. Selker Aug. 1975 37 p refs
(Contract EPA-68-02-1367)
(PB-246889/0; EPA-650/2-73-005-b-2a) Avail: NTIS HC $4.00 CSCL 13A

Results are given of a program to reduce NOx from tangential coal-fired boilers. Results are based on current contractor experience, as well as on field performance tests. Use of overfire air as a NOx control technique is discussed relative to: equipment modifications and costs (as of March 1975) associated with applying this technology to existing steam generators; limitations to the general application of developed technology; and emission control and cost effectiveness of applying developed technology to new steam generator designs. GRA

N76-20741# Abcor, Inc., Cambridge, Mass. Walden Research Div.
IMPACT OF ENERGY SHORTAGE ON AMBIENT SULFUR DIOXIDE AND PARTICULATE LEVELS IN METROPOLITAN BOSTON AQCR
Richard D. Siegel, Peter H. Guldberg, Kenneth W. Wiltsee, Jr., and Ralph B. DAgostino Jul. 1975 212 p refs
(Contract EPA-68-02-1830)
(PB-246592/0; EPA-450/3-75-068) Avail: NTIS HC $7.75 CSCL 13B

The present day oil shortage has led to relaxation of some fuel restrictions, allowing conversions from oil to coal and thereby increasing emissions of sulfur dioxide and particulates to the atmosphere. The purpose of this project was to evaluate the impact of the energy shortage on ambient sulfur dioxide (SO2) and total suspended particular (TSP) concentrations in a major urban area, metropolitan Boston. A combined approach based on a statistical analysis of measured air quality data, regulatory and emission analysis, and diffusion modeling of changes in ambient pollutant concentrations was used to attain this objective. GRA

N76-20742# Asian Inst. of Tech., Bangkok (Thailand).
THE RECLAMATION OF DRINKING WATER FROM SEWAGE Annual Report, 1 Jan. - 31 Dec. 1972
M. G. McGarry 4 Feb. 1975 75 p refs
(Grant DA-RDRF-S92-544-72-G181; DA Proj. 2M0-61102-B-52B; DA Proj. 2M0-61102-B-53B)
(AD-A008453; ARDG(FE)-472-2) Avail: NTIS CSCL 13/2

Indirect reuse of wastewater in drinking water supplies is common practice in industrialized states today. The investigations reported upon have been directed towards improvements upon existing techniques more applicable to the tropical and savanna developing country. High costs and technical difficulties have been encountered in the removal of nitrogen and low level organics. In this study, investigations have been conducted into nitrogen striping by photosynthetic algal growth, using the nitrogen as a nutrient with subsequent algae harvest from ponds, and low level organics reduction by (1) powdered activated carbon treatment and (2) semi-rapid filtration. Several processes, including high rate treatment oxidation ponds, dissolved air flotation, roughing filtration, photosynthetic nitrogen stripping ponds, powdered activate d carbon adsorption, dual-media filtration and chlorination were developed and specifically applied to domestic wastewater reclamation for drinking water. These were incorporated into two process streams, one using activated carbon for low level organics removal and the other semi-rapid filtration. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-20743 Stanford Univ., Calif.
PART 1: THE INTERACTION OF GRAVITATIONAL WAVES WITH MATTER. PART 2: THE DESIGN AND CONSTRUCTION OF A CRYOGENIC GRAVITATIONAL WAVE DETECTOR Ph.D. Thesis
Stephen Paul Boughn 1975 216 p
Avail: Univ. Microfilms Order No. 76-5695

Gravitationally induced modifications of the Coulomb interaction are examined. The electromagnetic radiation induced by a gravitational wave incident on a point charge and static point dipole is calculated and the astrophysical significance of this process discussed. Existing and proposed gravitational radiation detectors are discussed and theory of the mass quadrupole detector reviewed. In section two, the cryogenic system of a low temperature gravity wave detector is discussed. A unique feature of this system is the magnetic levitation of the gravity wave antenna. An experimental investigation of the behavior of type II superconducting magnet shields was undertaken and the results are reported. Important noise sources for the gravity wave detector are discussed and an optimum method of linear filtering developed. A description is given of a signal processing system designed to identify short kilocycle pulses of gravitational radiation. Finally, the results of preliminary experiments with the cryogenic gravity wave detector are reported. Dissert. Abstr.

N76-20744# Lockheed Missiles and Space Co., Palo Alto, Calif.
VERTICAL TEMPERATURE PROFILES AND SPECIFIC HUMIDITY IN A FREE ATMOSPHERE

V. A. Deviatova 1974 15 p refs Transl. into ENGLISH from Tr. Gidrometeorolog. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 132, 1974 p 98-114
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Results of vertical aircraft sounding for thirteen years in the Moscow area (for the cold half-year from 1958 to 1968, and for the warm half-year from 1956 to 1968) are used to extrapolate temperature profiles and specific heat. The temperature and specific humidity profiles for the cold half-year were obtained in 200 realizations, and for the warm half-year in 90 realizations. Soundings in days with air-mass single-layer continuous stratocumulus and stratus cloudiness were selected, when the temperature inversion started right above the upper cloud boundary. Cases were low clouds under the Sc or St layer or cloud layers were observed above them were eliminated. Clouds with a 2.5 km upper boundary were also not included. Taken as the cold half-year was the period from October to March, and as warm, from April to September. The temperature mode was taken into account in the distribution of rises over the half-years. The sounding time was not taken into account.
Author

N76-20745*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A MODEL FOR POLAR CAP ELECTRIC FIELDS
Nicola DAngelo Mar. 1976 37 p refs
(Grant NGL-16-001-002)
(NASA-CR-146773; U-of-Iowa-76-10) Avail: NTIS HC $4.00 CSCL 04A

A model is proposed relating polar cap ionospheric electric fields to the parameters of the solar wind near the orbit of the earth. The model ignores the notion of field line merging. An essential feature is the role played by velocity shear instabilities in regions of the outer magnetosphere, in which mapping of the magnetosheath electric field would produce sunward convection. The anomalous resistivity which arises from velocity shear turbulence, suffices to essentially disconnect the magnetosphere from the magnetosheath, at any place where that resistivity is large enough. The magnetosheath-magnetosphere system, as a consequence, acts as a kind of diode or rectifier for the magnetosheath electric fields. Predictions of the model are compared with several observations related to polar cap convection.
Author

N76-20746*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATIONS OF SATELLITE TECHNOLOGY TO GRAVITY FIELD DETERMINATION
P. Argentiero and B. Lowrey Dec. 1975 35 p refs Submitted for publication
(NASA-TM-X-71086; X-932-75-312) Avail: NTIS HC $4.00 CSCL 08N

Various techniques for using satellite technology to determine the earth's gravity field are analyzed and compared. A high-low configuration satellite to satellite tracking mission is recommended for the determination of the long wavelength portion of the gravity field. Satellite altimetry and satellite gradiometry experiments are recommended for determination of the short wavelength portion of the gravity field. The recently developed least squares collocation method for estimating the gravity field from satellite derived data is analyzed and its equivalence to conventional methods is demonstrated.
Author

N76-20747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMPROVEMENT IN THE GEOPOTENTIAL DERIVED FROM SATELLITE AND SURFACE DATA (GEM 7 AND 8)
C. A. Wagner, F. J. Lerch, J. E. Browndd (Computer Sci. Corp., Silver Spring, Md.), and J. A. Richardson (Computer Sci. Corp., Silver Spring, Md.) Jan. 1976 13 p refs Submitted for publication
(NASA-TM-X-71088; X-921-76-20) Avail: NTIS HC $3.50 CSCL 08N

A refinement was obtained in the earth's gravitational field using satellite and surface data. In addition to a more complete treatment of data previously employed on 27 satellites, the new satellite solution (Goddard Earth Model 7) includes 64,000 laser measurements taken on 7 satellites during the international satellite geodesy experiment (ISAGEX) program. The GEM 7, containing 400 harmonic terms, is complete through degree and order 16. The companion solution GEM 8 combines the same satellite data as in GEM 7 with surface gravimetry over 39% of the earth. The GEM 8 is complete to degree and order 25. Extensive tests on data independent of the solution show that the undulation of the geoidal surface computed by GEM 7 has an accuracy of about 3m (rms). The overall accuracy of the geoid estimated by GEM 8 is estimated to be about 4-1/4m (rms), an improvement of almost 1m over previous solutions.
Author

N76-20748*# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
THE EARTH AS A RADIO SOURCE
Donald A. Gurnett (Iowa Univ.) Sep. 1975 32 p refs Submitted for publication Sponsored in part by Alexander von Humboldt Found.
(Contracts NAS1-11257; NAS5-11074; NAS1-13129; NAS5-11431; Grant NGL-16-001-043; Contract N00014-68-A-0196-0009)
(NASA-CR-145827; MPI-PAE/Extraterr-112) Avail: NTIS HC $4.00 CSCL 03A

The primary characteristics of radio emission from the earth's magnetosphere are summarized, the origins of these missions are considered and similarities to other astronomical radio sources discussed. The auroral kilometric radiation has features very similar to Io-related decametric radiation from Jupiter and from Saturn. The radiation at fp and 2 fp upstream of the bow shock appears to be generated by the same mechanism as type III solar radio bursts. The beaming of the auroral kilometric radiation into a cone shaped region over the polar cap has some similarity to the angular distribution of radiation from Io and to the beaming of radio emission from pulsars.
ESA

N76-20749*# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
PLASMA WAVE INTERACTIONS WITH ENERGETIC IONS NEAR THE MAGNETIC EQUATOR
Donald A. Gurnett (Iowa Univ.) Oct. 1975 23 p refs Submitted for publication Sponsored in part by Alexander von Humboldt Found.
(Contracts NAS1-11257; NAS5-11074; NAS1-13129; NAS5-11431; Grant NGL-16-001-043; Contract N00014-68-A-0196-0009)
(NASA-CR-146752; MPI-PAE/Extraterr-116) Avail: NTIS HC $3.50 CSCL 03B

An intense band of electromagnetic noise is frequently observed near the magnetic equatorial plane at radial distance from about 2 to 5 Re. Recent wideband wave-form measurements with the IMP-6 and Hawkeye-1 satellites have shown that the equatorial noise consists of a complex superposition of many harmonically spaced lines. Several distinctly different frequency spacings are often evident in the same spectrum. The frequency spacing typically ranges from a few Hz to a few tens of Hz. It is suggested that these waves are interacting with energetic protons, alpha particles, and other heavy ions trapped near the magnetic equator. The possible role these waves play in controlling the distribution of the energetic ions is considered.
Author (ESA)

N76-20750# Royal Netherlands Meteorological Inst., De Bilt.
A SIMPLE MODEL FOR CALCULATING THE VARIATION IN ION DENSITY OF THE E LAYER CAUSED BY AN INTERNAL GRAVITY WAVE [EEN EENVOUDIG MODEL VOOR DE BEREKENING VAN DE VERANDERING IN DE IONENDICHTHEID VAN DE E-LAAG VEROORZAAKT DOOR EEN INWENDIGE ZWAARTEKRACHTGOLD]
H. Kelder 1975 29 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-12) Avail: NTIS HC $4.00

The changes induced by an internal gravity wave in the ion density of the E layer were calculated. Assumed is the Chapman model for the ion density distribution in this layer. Further assumptions are that the neutral atmosphere is originally at rest and isothermal and that the wave amplitude above 150 km altitude is constant due to viscosity and heat conduction. The magnitudes of the transport term and the photoionization term

are compared. The variation in ion density appears to be of the order of percents. ESA

N76-20751# Max-Planck-Institut fuer Aeronomie, Lindau Uber Northeim (West Germany). Inst. fuer Stratosphaerenphysik.
SPECIFIC OZONE DESTRUCTION RATE AND FLUX OVER BUSHY STEPPES FROM OZONE AND TEMPERATURE PROFILES DETERMINED ON A 120 m MAST IN TSUMEB/SOUTH WEST AFRICA [BESTIMMUNG DER SPEZIFISCHEN OZONENSTOERUNGSRATE UEBER BUSCHSTEPPE UND DES OZONFLUSSES IN DIESE OBERFLAECHE MIT HILFE VON OZON- UND TEMPERATURPROFILEN-MESSUNGEN AN EINEM 120 m-MAST IN TSUMEB/S. W.A.]
Peter-Joachim Wilbrandt Berlin Springer Verlag 1975 41 p refs In GERMAN; ENGLISH summary
(Rept-54/1975; ISBN-3-540-07437-6) Avail: NTIS HC $4.00

Calculations were made from ozone profiles averaged for two hour periods (5.00 h to 21.00 h) from measurements over the range 2.5 to 105 m height. Increasing stability in the layer correlates directly with the gradient of the average ozone profile which is logarithmic in form. Making assumptions on prevailing transport mechanisms, the ozone flux was calculated for the whole period in which measurements were taken. The correlation between amounts of ozone in layers from 2.5 to 105 m was examined. A comparison between Tsumeb and Windhoek showed no significant differences. ESA

N76-20752# Wyoming Univ., Laramie. Dept. of Physics and Astronomy.
STRATOSPHERIC AEROSOL MEASUREMENTS 3: OPTICAL MODEL CALCULATIONS Annual Report
J. M. Rosen and D. J. Hofmann Dec. 1974 45 p refs
(Contract N00014-70-A-0266-0005)
(AD-A016591; GM-25) Avail: NTIS CSCL 04/1

Mie single scattering, absorption and total extinction calculations for various size distribution and composition models of the stratospheric aerosol are presented. These models are derived from global in-situ measurements made with a balloon-borne photoelectric particle counter during the period December, 1971, through July, 1974. The models are in agreement with simultaneous aerosol mass measurements made by aircraft filter sampling and by balloon-borne impactor over Laramie, Wyoming. Nominal stratospheric aerosol optical depths at 0.53 micron wavelength are 0.005 to 0.007. The maximum stratospheric aerosol absorption cross section at this wavelength is 0.00004/km at 18-20 km altitude, assuming a refractive index imaginary part of 0.01. The predicted 180 deg backscatter lidar return at the 18-20 km altitude of maximum aerosol mixing ratio is 9% to 17% of the Rayleigh return at a wavelength of 0.6943 km for the various aerosol models. Measured and predicted lidar returns over Laramie, Wyoming, in September, 1972, are in good agreement for several of the size distribution and composition models used here. Values of the global stratospheric aerosol albedo at 0.53 micron are 0.002 to 0.003. Author

N76-20753# Naval Postgraduate School, Monterey, Calif.
COMPARISON OF SYNOPTIC SCALE WAVE DISTURBANCES IN THE TROPICAL WESTERN PACIFIC OCEAN BETWEEN 1972 AND 1973 M.S. Thesis
Charles Robert Miller, III Sep. 1975 68 p refs
(AD-A017633) Avail: NTIS CSCL 04/1

The structure and properties of the tropical easterly waves have been found to vary considerably between different regimes and time periods. This study investigates the possible roles played by the long-term sea-surface temperature (SST) variations in the upstream region on the waves. Time series of tropical western Pacific radiosonde data during two contrasting 8-month periods of SST anomalies, May-December 1972, which has abnormally high SST in the central and eastern Pacific, and May-December 1973 which has below normal SST in the same region are analyzed. In both periods, the waves have the same periodicity of 4-5 days and a zonal wavelength on the order of 3,500 km, but the vertical phase and amplitude distributions are different as well as the thermal structures. The results suggest that SST influences the waves in two ways: (1) direct effect, the warmer SST favors a better-defined warm core structure which increases the lower tropospheric wave amplitude; and (2) indirect effect, the variation of SST changes the large-scale mean wind circulation which, in turn, changes the vertical structure and upper tropospheric amplitude of the waves. GRA

N76-20754# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
PLANETARY SCALE WAVE RESPONSE TO AURORAL HEATING OF THE NEUTRAL ATMOSPHERE Interim Report
Yam T. Chiu 15 Oct. 1975 45 p refs
(Contract F04701-75-C-0076)
(AD-A017189; TR-0076(6960-04)-1; SAMSO-TR-75-234) Avail: NTIS CSCL 04/1

Observations of auroral forms by meteorological satellites, of detailed thermospheric density response to auroral heating and of wind fields at thermospheric altitudes indicate that both phenomena exhibit structures whose spatial scales are in the synoptic-planetary range. In order to study the propagation of these planetary scale disturbances, proper account of the wave vorticity transport must be taken. The author has formulated and solved the approximate Green's function response problem of atmospheric waves in a spherically rotating atmosphere valid for the full wave spectrum which ranges continuously from acoustic-gravity to Rossby waves. Numerical examples of wave response to an impulsive auroral band are given for a set of planetary surface modes. GRA

N76-20755# Teledyne Geotechnical, Alexandria, Va. SEISMIC Data Analysis Center.
PERFORMANCE OF THE PHILTRE PROCESSOR AT LOW SIGNAL-TO-NOISE RATIOS
P. A. Sobel and D. H. VonSeggern 31 Jul. 1975 49 p refs
(Contract F08606-76-C-0004; ARPA Order 1620)
(AD-A016537; SDAC-TR-75-6) Avail: NTIS CSCL 17/10

In this report it is shown that a non-linear, adaptive processor called PHILTRE is useful in detecting long-period Rayleigh waves in various low signal-to-noise ratio situations: signals buried in noise at various levels, two signals mixed at various azimuths and relative amplitudes, and a suite of visually undetected signals at LASA, ALPA, and NORSAR from the Kurils-Kamchatka region. PHILTRE lowered the detection threshold for Rayleigh waves buried in noise by about 6 dB. It was able to separate two signals if their azimuthal spearation was greater than 60 degrees and if at the same time the amplitude of the second signal was at least 20 percent of the amplitude of the first signal. It lowered Rayleigh-wave 50% detection thresholds by roughly 0.2 (m sub b) unit at the three long-period arrays. GRA

N76-20756# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
THE NATURAL STRATOSPHERE OF 1974, CIAP MONOGRAPH 1 Final Report
Sep. 1975 1339 p refs
(Contract DOT-OS-30057)
(PB-246318/0; DOT-TST-75-51) Avail: NTIS HC $41.75 CSCL 04A

The Climatic Impact Assessment Program (CIAP) of the U.S. Department of Transportation is charged with the 'assessment' of the impact of future aircraft fleets and other vehicles operating in, or transiting through, the stratosphere. CIAP monograph 1 gives a survey, largely from an experimental standpoint, of what is known in 1974 about the unperturbed stratosphere with respect to an application to stratospheric flight. It reviews the overall structure of the stratosphere, its origin in terms of ozone photochemistry, solar irradiance and overall radiative energy balance, other chemically reactive minor species, and atmospheric motions on a variety of scales of time and distance. The limitations of our understanding are emphasized in the presentation. Also, the monograph examines briefly what is known about the effect of massive injections of nitrogen oxides (from atmospheric nuclear explosions) and sulfur oxides (from major volcanic eruptions). GRA

N76-20757# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
PROPULSION EFFLUENTS IN THE STRATOSPHERE. CIAP MONOGRAPH 2 Final Report

Sep. 1975 472 p
(Contract DOT-OS-30057)
(PB-246319/8; DOT-TST-75-52) Avail: NTIS HC $12.00 CSCL 04A

The Climatic Impact Assessment Program (CIAP) of the U.S. Department of Transportation is charged with the 'assessment' of the impact of future aircraft fleets and other vehicles operating in, or transiting through, the stratosphere. The vehicular portion of the overall problem is treated in depth and emphasizes aircraft. The impact of future aircraft fleets depends on the introduction rate (e.g., kg/year) of pollutants, altitude, and to some extent, season and location at which such pollutants are injected. Thus, trends and projections for aircraft operations, to determine and thereby gain time to forestall climatic problems that might otherwise result are examined. Also technology improvements for minimizing adverse effects are examined. 'Upper-bound' and 'expected' projections are offered through the year 2000. The year 2025 is examined as an 'anchor point', i.e., as a time frame beyond that of interest but with which intermediate projections must be in line. In addition, emissions from the Space Shuttle vehicle, other rockets, and hypersonic transport (research vehicles only) are noted. GRA

N76-20758# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Quality and Modification Div.
VERTICAL PROFILES OF HTO, HDO, AND H2O IN THE TROPOSPHERE
Dieter H. Ehhalt Nov. 1974 136 p refs Sponsored by NSF
(PB-245731/5; NCAR-TN/STR-100) Avail: NTIS HC $6.00 CSCL 04A

Most of the tritium (T) present in the environment was produced by thermonuclear explosions and injected into the stratosphere; the largest such contribution came from the Soviet test series in 1961 and 1962. Natural T production by cosmic radiation plays only a minor role. Most of the bomb tritium reacts during cooling of the fireball to form tritiated water, HTO. HTO mixes down from the stratosphere into the troposphere and accumulates in surface waters, mainly the oceans, thereby entering all stages of the hydrological cycle. HTO is therefore a tracer particularly well suited to the study of the natural water cycle. Vertical profiles are presented of tritium, deuterium, and water vapor in the troposphere that were obtained by NCAR at various times from 1966 through 1973. GRA

N76-20759# RAND Corp., Santa Monica, Calif.
A NEW (REVISED) TABULATION OF THE SCRIPPS TOPOGRAPHY ON A 1 DEGREE GLOBAL GRID. PART 1: TERRAIN HEIGHTS
W. L. Gates and A. B. Nelson Oct. 1975 139 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A017560) Avail: NTIS CSCL 08/6

A revision and retabulation of world-wide terrain height data originally prepared at the Scripps Institution of Oceanography is presented. Revisions to the original data include the insertion of the elevation of the surface of lakes, the negative elevation of land areas lying below sea level, and the elevation of heretofore omitted islands. A number of errors have also been corrected, and changes made in the land elevation near coasts. The newly formatted global 1-deg tabulations of terrain data are supplemented by a global analysis, frequency histograms, and zonal averages. GRA

N76-20760# RAND Corp., Santa Monica, Calif.
A NEW (REVISED) TABULATION OF THE SCRIPPS TOPOGRAPHY ON A 1 DEGREE GLOBAL GRID. PART 2: OCEAN DEPTHS
W. L. Gates and A. B. Nelson Oct. 1975 140 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A017567; R-1277-1-ARPA-Pt-2) Avail: NTIS CSCL 08/10

A revision and retabulation of world-wide ocean depth data originally prepared at the Scripps Institution of Oceanography is given. Revisions to the original data include the redefinition of coastal regions and the insertion of islands and lakes; no revision has been made in the remaining oceanic depths. The newly formatted global 1-deg tabulations of ocean depth are supplemented by a global analysis, frequency histograms, and zonal averages. GRA

N76-20761# Joint Publications Research Service, Arlington, Va.
PRINCIPLES FOR ORGANIZING A SYSTEM FOR THE AUTOMATIC PROCESSING OF GRAVIMETRIC INFORMATION
P. A. Besprozvannyy, V. A. Boldyreva, N. D. Kanter, and A. A. Chernov 25 Mar. 1976 10 p refs Transl. into ENGLISH from Razved. Geofiz. (USSR), no. 56, 1973
(JPRS-67028) Avail: NTIS HC $3.50

A formulation is given of the fundamental requirements imposed on an automatic processing complex for use in gravimetric prospecting. Author

N76-20762# Systems Control, Inc., Palo Alto, Calif.
CLIMATIC IMPACT ASSESSMENT PROGRAM ERROR VARIANCE ANALYSIS. STATISTICAL ASPECTS OF ATMOSPHERIC MONITORING Final Report, 1 Jan. - 30 Jun. 1975
R. B. Schainker Jul. 1975 142 p refs
(Contract DOT-OS-40042)
(PB-246415/4; SCI-5108-5; DOT-TST-75-134) Avail: NTIS HC $6.00 CSCL 07D

Statistical aspects of pollution montoring are examined along with factors that must be considered in monitoring network design. Analytical studies in trend analysis, sensitivity analysis, and causal discrimination analysis are discussed. A summary is included of the current knowledge of ozone spatial and temporal distributions and their causes. GRA

N76-20763# Clarkson Coll. of Technology, Potsdam, N.Y.
REMOTE SENSING OF PARTICLE SIZE AND REFRACTIVE INDEX BY VARYING THE WAVELENGTH
Milton Kerker and Derry D. Cooke Oct. 1975 29 p refs
(Grant NOAA-04-4-022-21)
(PB-246964/1; NOAA-75102903) Avail: NTIS HC $4.00 CSCL 04A

This is a numerical study to explore the feasibility of determining particle size and refractive index in the atmosphere from the backscattered signal combined with a signal differentially scattered at one other angle. The wavelength of the radiation is varied over a broad range (in the particular example chosen, from lambda = 0.5 to 1.5 micrometer). Three signatures of the particle size and refractive index are chosen: (1) deviation of the radiance from the inverse fourth power of the wavelength, (2) the first maximum of the variation of the angular intensity function with wavelength, and (3) the first two maxima of the variation of the phase difference of the amplitudes of the polarized radiances with wavelength. For monodisperse systems, these signatures will permit estimation of particle size in the forty-fold range a = 0.033 to 1.29 micrometers (for m = 1.50). GRA

N76-20764# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
MODEL INVESTIGATIONS OF ICE ENTRAINMENT BENEATH EDGE OF AN ICE COVER
A. M. Filippov May 1975 11 p refs Transl. into ENGLISH from Tr Gos. Gidrolog. Inst. (USSR), no. 201, 1973 p 107-114
(AD-A009694; CRREL-TL-475) Avail: NTIS CSCL 08/12

Model investigations of the drawing in of slush and ice under the edge of an ice sheet are a component part of the study of ice-dam and ice-jam formation processes in rivers, as well as a stage in the experimental development of methods for the hydraulic regulation of slush and ice movements. By using this type of research, it is possible to determine the conditions governing the drifting of ice blocks of various lengths, widths and thicknesses under an ice sheet for flows having different hydraulic parameters. GRA

N76-20765# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.
PROPERTIES OF EXPANSIVE CLAY SOILS. REPORT 2: A NUMERICAL PROCEDURE FOR PREDICTING HEAVE WITH TIME
Lawrence D. Johnson and Chandrakant S. Desai Apr. 1975 61 p refs
(AD-A009492; AEWES-Misc-Paper-S-73-28-2; Rept-2) Avail: NTIS CSCL 08/13

A relatively economical and expedient numerical procedure and computer code based on the finite difference method were developed for predicting heave with time for heterogeneous expansive soils beneath structures idealized as two-dimensional. The computer code will also compute the potential heave assuming saturation of the foundation soils based on McDowell's swell data. The heave with time estimates should be useful for structures near which penetration of rainwater from the ground surface is permitted, provided that ponding of surface water and external water from leaking water and sewer lines does not occur. The potential heave should be useful if the foundation soils become saturated from excessive watering, poor surface drainage, and leaking water and sewer lines. The required input data include the structural load, specific gravity, liquid and plastic limits, initial dry density and water content, coefficient of vertical permeability, ratio of the horizontal to the vertical coefficient of permeability, and swell and suction relationships of the foundation soils. GRA

N76-20568* Memorial Univ. of Newfoundland, St. Johns.
THE EARTH'S ROTATION
M. G. Rochester *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 27-39 refs Repr. from Conf. Proc. E(Earth)S v. 54, no. 8, Aug. 1973 Sponsored in part by Natl. Res. Council of Can. (For availability see N76-20566 11-42)
CSCL 08E

N76-20569* Scripps Institution of Oceanography, La Jolla, Calif.
EPEIROGENY AND PLATE TECTONICS
Henry W. Menard *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 51-62 refs Repr. from Conf. Proc. E(Earth)S, v. 54, no. 12, Dec. 1973 (For availability see N76-20566 11-42) (Grant NSF GA-39219)
CSCL 08E

N76-20570* Ohio State Univ. Research Foundation, Columbus.
THE GEOID: DEFINITION AND DETERMINATION
Richard H. Rapp *In its* Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 69-77 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 3, Mar. 1974 (For availability see N76-20566 11-42)
CSCL 08E

N76-20572* California Univ., San Diego.
CURRENT STATUS OF UNDERSTANDING QUASI-PERMANENT FIELDS ASSOCIATED WITH EARTHQUAKES
James N. Brune *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 103-110 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 9, Sep. 1974 (For availability see N76-20566 11-42)
CSCL 08K

N76-20573* Department of Energy, Mines and Resources, Ottawa (Ontario).
RECENT AND LATE QUATERNARY CHANGES IN WATER LEVEL
Richard I. Walcott *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 117-127 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 2, Feb. 1975 (For availability see N76-20566 11-42) (Contrib-519) CSCL 08H

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-20766 Direction de la Meteorologie Nationale, Paris (France). Service Meteorologie Metropolitain.
AGROMETEOROLOGICAL STUDY OF CORN: APPLICATION TO THE PREDICTION OF PHENOLOGICAL STEPS AND YIELD FORECAST [CONTRIBUTION A L'ETUDE AGROMETEOROLOGIQUE DU MAIS: APPLICATIONS A LA PREVISION DES PHASES PHENOLOGIQUES ET DES RENDEMENTS]
P. Brochet, N. Gerbier, and J. Bedel Jun. 1975 71 p refs In FRENCH
(MN-Mono-95) Avail: Issuing Activity

The agronomical bases for corn cultivation are reviewed. Two methods are presented using temperature data and polynomial linear smoothing to growth velocities in order to forecast the completion dates of the major phenological steps. Results are discussed together with possible uses in adjusting various species of corn to local climatological conditions. Yield forecast as a function of climatological factors were analyzed using multiple regression analysis at the scale of a French department. A simulation method for controlling the results is discussed. ESA

N76-20767 Direction de la Meteorologie Nationale, Paris (France). Centre d'Etude de la Neige - St.-Martin d'Heres.
SNOW CRYSTALS AND THEIR METAMORPHOSIS [LES CRISTAUX DE NEIGE ET LEURS METAMORPHOSES]
Edmond Pahaut Jun. 1975 64 p refs In FRENCH
(MN-Mono-96) Avail: Issuing Activity

The various processes for snow formation and metamorphosis are reviewed together with data on snow volumic mass. The main series of snow crystal transformations are presented in the form of photographs taken in natural environment. ESA

N76-20768 Direction de la Meteorologie Nationale, Paris (France). Bureau Climatologique Regional - Strasbourg.
FOEHN EFFECT IN THE ALSATIAN PLAIN [L'EFFET DE FOEHN DANS LA PLAINE D'ALSACE]
R. Chappaz Aug. 1975 46 p refs In FRENCH
(MN-Mono-97) Avail: Issuing Activity

Basic notions on the Foehn effect and its influence on rain precipitation in the Alsatian plain are reviewed. The correlation between wind strength and direction at 1,600 m altitude were analyzed with regard to precipitations in Alsace and west of the Vosges. Indices were developed to forecast the importance and localization of the Foehn effect with a view to studying the influence on temperature and precipitation distribution. ESA

N76-20769 Direction de la Meteorologie Nationale, Paris (France). Bureau de l'Eau.
TYPICAL PLUVIOMETRIC SITUATIONS [SITUATIONS PLUVIOMETRIQUES TYPES]
R. TrenDel, M. C. Rulliere, and A. DeBilly Nov. 1975 89 p In FRENCH
Avail: Issuing Activity

A set of 155 typical pluviometric situations classified under 50 subsets and based on an 11 year survey (1961 to 1971) of the daily rain distribution are displayed for France. Automatic cataloging methods were used, the file containing 4,017 elements each defined by 90 measurements. The extension of the method to the period 1946 to 1975 and 1875 to 1906 is contemplated, requiring the cataloging of 22,000 events. Various applications are outlined. ESA

N76-20770# Lockheed Missiles and Space Co., Palo Alto, Calif.
CERTAIN RELATIONSHIPS BETWEEN PRECIPITATION AND THE FORM OF CLOUDINESS IN PHOTOGRAPHS FROM A SATELLITE
T. P. Popova 1974 9 p refs Transl. into ENGLISH from Tr. Gidrometeorolog. Nauchn.-Issled. Tsentr SSSR (Leningrad), no. 132, 1974 p 88-97
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The relationship between the area covered by clouds on a photograph from space and the area covered by precipitation on the earth's surface and the relationship between precipitation and values of the radiation temperature of the upper cloud boundary measured by satellite apparatus, are considered. It is indicated that satellite information can be used for a qualitative diagnosis of precipitation at earth's surface. Results are discussed of a statistical analysis of the relations between precipitation and the form of cloudiness on photographs from a satellite. Author

N76-20771*# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
INITIALIZATION PROCEDURES FOR PRIMITIVE EQUATION MODELS
William K-F. Grant (AF HQ Air Weather Service, Scott AFB, Ill.) and Eugenia Kalnay DeRivas [1975] 45 p refs
(Grants NGR-22-009-727)
(NASA-CR-146553) Avail: NTIS HC $4.00 CSCL 04B

A linear analysis and comparison of the damping properties of six dynamic initialization schemes is presented, indicating that the Okamura-Rivas scheme has the most efficient damping properties over the whole frequency range, and suggesting that it should be faster than the other methods and given more stable results. The results obtained with a nonlinear shallow water equations model agree well with the linear analysis. The Okamura-Rivas scheme attains complete balance in the equivalent of 5 to 6 hours of leapfrog forecasting, and requires in this model an order of magnitude less computation than the balance equation solution. Author

N76-20772# RAND Corp., Santa Monica, Calif.
NEW METHODS FOR ATMOSPHERIC TEMPERATURE INVERSION
H. H. Kagiwada and R. E. Kalaba Oct. 1975 44 p refs
(Contract C-5-35179)
(R-1810-Doc) Avail: NTIS HC $4.00

The problem of estimating temperature profiles in the atmosphere based on remote radiation measurements is usually stated as an integral equation of the first kind. Such an equation may be difficult to solve. It is demonstrated that it is sensible to state the problem as a system indentification problem. Quasilinearization is shown to be a feasible method of solution, and is illustrated by numerical examples. This approach makes use of the digital computer's ability to solve initial value (Cauchy) problems. It is important, in the new approach, either to avoid linear algebraic equations completely or to improve the ease with which they can be solved. Several methods have potentially direct effects on the integral equation of the first kind. Author

N76-20773# Technische Hogeschool, Delft (Netherlands).
THE FLOW PATTERN IN THE EXIT PIPE OF A CYCLONE Ph.D. Thesis
Michael Loxham 1976 75 p refs
Avail: NTIS HC $4.50

The flow pattern downstream of a cyclone when it is used to clean gases was found to be intense, decaying, axial swirl flow. The axial velocity component in the middle of the tube is reduced and there is a corresponding increase near the wall. The swirl component is up to twice the superficial velocity and the radial velocity component is negligible. Time smoothed Navier-Stokes equations were simplified to give a "swirl equation" from which the spindown can be calculated. The heat transfer rate between the gas and the exit pipe wall is much higher than that expected for non-swirling turbulent flow. A model for the heat transfer based upon a modification of the analogy between momentum and heat transfer was developed. The two-phase flow pattern in the exit pipe was shown to be a simple co-current, annular flow with swirl. The film thicknesses and surface velocities were studied; the results can be correlated in terms of the interfacial friction factor through the solution of laminar Navier Stokes equations. Author

N76-20774*# Texas A&M Univ., College Station.
ATMOSPHERIC STRUCTURE AND VARIABILITY IN AREAS OF CONVECTIVE STORMS DETERMINED FROM 3-h RAWINSONDE DATA
Gregory S. Wilson and James R. Scoggins Washington NASA Apr. 1976 129 p refs
(Contract NAS8-26751)
(NASA-CR-2678) Avail: NTIS HC $6.00 CSCL 04B

The structure and variability of the atmosphere in areas of radar-observed convection were established by using 3-h rawinsonde and surface data from NASA's second Atmospheric Variability Experiment. Convective activity was shown to exist in areas where the low and middle troposphere is moist and the air is potentially and convectively unstable and has upward motion, in combination with positive moisture advection, at either the surface or within the boundary layer. The large variability of the parameters associated with convective storms over time intervals less than 12 h was also demonstrated so as to possibly produce a change in the probability of convective activity by a factor of 8 or more in 3 h. Between 30 and 60 percent of the total changes in parameters associated with convective activity over a 12-h period were shown to take place during a 3-h period. These large changes in parameters are related to subsynoptic-scale systems that often produce convective storms. Author

N76-20775# Royal Netherlands Meteorological Inst., De Bilt.
WIND MEASUREMENTS AT THE 80 m MAST AT VLAARDINGEN IN 1967 AND 1968 [WINDMETINGEN AAN DE 80 m-MAST TE VLAARDINGEN IN 1967/68]
W. R. Raaff 1975 79 p refs In DUTCH; ENGLISH summary
(KNMI-WR-75-11) Avail: NTIS HC $5.00

Results are presented and discussed of wind measurements at a mast of 80 m height located near Vlaardingen (Netherlands) during the period April 4, 1967 to April 4, 1968. ESA

N76-20776# Danish Meteorological Inst., Copenhagen.
UNMANNED GEOPHYSICAL OBSERVATORIES IN NORTH GREENLAND, 1972 - 1974
Gunnar Jensen (Danish AEC), Leif Kristensen (Danish AEC), and Joergen Taagholt 1974 71 p refs
(ISBN-87-7478-096-4) Avail: NTIS HC $4.50

Meteorological measurements at two Unmanned Geophysical Observatories (UGO), one installed at Station Nord, the other at Kap Harald Moltke, are reported. An account is given of the experience with the two UGO-systems, the instrumentations including a datalogger, a temperature sensor system, anemometer, wind direction sensor, the modifications and improvements made, as well as processing of the climatoglogical data. ESA

N76-20777# Denver Research Inst., Colo.
CLOUD CONDENSATION NUCLEUS SPECTROMETER Final Report
V. K. Saxena and N. Fukuta Dec. 1974 29 p refs
(Contract N00019-74-C-0220)
(AD-A016957; DRI-2657) Avail: NTIS CSCL 14/2

The project was initiated to develop and test an instrument capable of measuring the activity spectrum of the cloud condensation nuclei (CCN) by simultaneously simulating a range of supersaturations encountered in cloud or fog formation. The design, fabrication, and testing of such an instrument has been successfully completed. This CCN spectrometer has definite advantages over all the CCN counters presently in use. A range of supersaturations, rather than only one supersaturation, can be produced and sustained at a given point in time. The spectrometer will be used for marine fog measurements. GRA

N76-20778# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE USE OF A BALANCE EQUATION MODEL IN NUMERICAL WEATHER PREDICTION Environmental Research Papers
Samuel Y. K. Yee 4 Aug. 1975 21 p refs
(AF Proj. 8604)
(AD-A017041; AFCRL-TR-0424; AFCRL-ERP-525) Avail: NTIS CSCL 04/2

The finite-difference solution to a balance equation model is discussed in terms of the solution to a coupled, linear elliptic system with variable coefficients (both in space and time). By suitably arranging the unknowns in their finite-difference analogs, this coupled system is in fact no more than just one large linear algebraic system. Thus for a two-level model, the problem of solving a system of four coupled equations becomes that of solving a single algebraic system of (4JK) unknowns. GRA

N76-20779# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPUTER MODELING OF MEASUREMENT OF WINDS BENEATH AIRCRAFT USING OMEGA SIGNAL BETRANSMISSION Instrumentation Papers
James F. Morrissey 23 Jun. 1975 24 p refs
(AF Proj. 6670)
(AD-A017042; AFCRL-TR-75-0346; AFCRL-IP-234) Avail: NTIS CSCL 04/2

The results of a computer model of the problem of measuring wind speed and direction beneath an airplane with retransmitted Omega signals are presented. The model simulates aircraft motion, sonde motion, signal-to-noise variation. Omega timing sequences, and the principal tracking features of the Beukers: WO-3 processing system. This WO-3 processor provides a measurement of the arrival time and signal quality for each of three Omega frequencies for each of four Omega stations. The tracking of only three stations at any one time was simulated. The simulation results are compared to the results of field test data and are found to be in reasonable agreement. The simulation results predict that an improvement in performance is possible for the poor SNR situations (-0 db) by modifying the tracking algorithms of the processor. GRA

N76-20780# Naval Postgraduate School, Monterey, Calif.
THE MODELLING OF MONSOON CIRCULATION DURING NORTHERN SUMMER M.S. Thesis
James Richard Bellis Sep. 1975 57 p refs
(AD-A017541) Avail: NTIS CSCL 04/2

The numerical model formulated by Monaco and Williams (1975), which is essentially similar to the UCLA general circulation model, was used to simulate the northern summer monsoon. The model was truncated to a three-level window model which covers the region, 0 deg - 180 deg E and 18 deg S - 46 deg N only. The zonally asymmetric motions are driven by a specified heating function which resembles the 200 mb seasonal mean divergence field observed by Krishnamurti and Rogers (1970). Major planetary-scale features of the monsoon are reasonally simulated along with development of synoptic scale transient disturbances at upper levels. The results indicate that the present model is suitable for more elaborate studies of the southwest monsoon. Author (GRA)

N76-20781# Naval Postgraduate School, Monterey, Calif.
SOME DESIGN EXPERIMENTS FOR A NESTED GRID FORECAST MODEL OF WESTERN PACIFIC TROPICAL CYCLONES M.S. Thesis
Gary William Ley Sep. 1975 74 p refs
(AD-A017532) Avail: NTIS CSCL 04/2

A three-dimensional, triply nested tropical cyclone forecast model was initialized from hand-analyzed synoptic-scale wind data. The diagnostic phase forced the mass fields from the wind fields by use of a suitable balance equation. Latent heat parameterization and frictional dissipation were omitted from the model to study movement primarily due to advective processes. For comparison, a three-level uniform coarse mesh grid model was initialized with the same real data. Time averaging of the pressure gradient terms of the momentum equations was incorporated into each model in an attempt to increase the maximum time increment. Movement forecasts of Typhoon Irma to 48-hours with both dynamic models were compared with operational forecasts and the post-analysis 'best' track. Very satisfactory movement prognoses were obtained for the three periods forecasted with the dynamic models. The models correctly forecast the passage of a 500-mb trough to the north of the typhoon, apparently preventing recurvature. For movement forecasts, it appears that the nested model can be initialized with linear interpolation of data from the coarse grid to the finer mesh grids. The time increment was increased through use of the pressure averaging in the uniform CMG model; however, no time step increase was realized with the nested model due to lattice separation of the solution. Author (GRA)

N76-20782# Naval Postgraduate School, Monterey, Calif.
FOG SEQUENCES ON THE CENTRAL CALIFORNIA COAST WITH EXAMPLES M.S. Thesis
Craig Allen Peterson Sep. 1975 89 p refs
(AD-A017528; NPS-58LR75091) Avail: NTIS CSCL 04/2

In the low visibility range, forecasts during the summer period along the west coast of California are presently not made with any degree of accuracy. Modeling sequences associated with the nonfrontal fog formations during the summer period offer the possibility of improving fog diagnosis. Such sequences have been in use in Southern California for some time. This study uses a synoptic approach, focusing on sequences observed in the non-diurnal aspects of coastal fog. A development model is presented in order to delineate patterns of the fog phenomenon along the central California coast. Actually observed fog situations are presented in order to evaluate the model and determine if day-to-day changes in specific non-diurnal indices represent trends which can aid forecasters. Results show that, although the model is general in nature, a correlation between the stages of the observed fog exists. The relationship of the time of occurrence of dense fog and the trends in the height of the inversion base and daily maximum temperatures at the top of the inversion and the inland valley are pointed out. Author (GRA)

N76-20783# Interdepartmental Committee for Atmospheric Sciences, Washington, D.C.
NATIONAL ATMOSPHERIC SCIENCES PROGRAM, FISCAL YEAR 1975
May 1974 102 p refs
(PB-246280/2; ICAS-18) Avail: NTIS HC $5.50 CSCL 04B

The report includes: program summaries; agency programs; physical and dynamic meteorology; meteorological support activities; funding; polar research; weather modification; aeronomy; and planetary atmosphere missions. GRA

N76-20784# National Center for Atmospheric Research, Boulder, Colo.
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH: NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, FISCAL YEAR 1975 Final Annual Report
1975 159 p Sponsored by NSF
(PB-246563/1) Avail: NTIS HC $6.00 CSCL 04B

The report of the National Center for Atmospheric research for fiscal year 1975 describes on-going research activities and the most significant recent achievements of this national laboratory, which is operated by the 44-member University Corporation for Atmospheric Research under sponsorship of the National Science Foundation. Emphasis in the report's research highlights section is on large scale weather prediction, climatic trends, prediction and modification of severe weather, solar processes and their influences, and trends of upper atmosphere air quality. The report points to many joint research projects between NCAR and university researchers and to aviation, high-altitude ballooning, computing, and field observing support facilities which NCAR maintains for use by the university research community. Directories of scientific and engineering staff, visitors, publications, organizational structure, and financial statements comprise the latter half of the report. Abundant illustrations and a semitechnical narrative make the report accessible to a wide readership of science administrators, decision makers, students, and interested laymen. GRA

N76-20785# Meteorology Research, Inc., Altadena, Calif.
CLOUD PHYSICS AIRCRAFT AND DATA SUPPORT FOR AGGRAVATED EROSION Final Report, 10 Nov. 1973 - 31 Aug. 1973
Don Takeuchi and Stefan Steinberg Aug. 1975 34 p refs
(Contract F19628-74-C-0089; AF Proj. 627A)
(AD-A017089; MRI-75-FR-1353; AFCRL-TR-75-0323) Avail: NTIS CSCL 04/2

Cloud particle size measurements taken by the Knollenberg probes during the winter of 1974 by the MRI research aircraft near Wallops Island, Virginia, are discussed. Author (GRA)

N76-20786# North Carolina State Univ., Raleigh.
ATMOSPHERIC TURBULENCE PROPERTIES IN THE LOWEST 300 METERS Final Report
A. H. Weber, J. S. Irwin, J. P. Kahler, and W. B. Peterson Jul. 1975 164 p refs
(Grant EPA-800662)
(PB-246215/8; EPA-600/4-75-004) Avail: NTIS HC $6.75 CSCL 04B

Analyses of atmospheric turbulence data for a nonhomogeneous terrain collected at the SRL-WJBJ Meteorological Facility at Beach Island, South Carolina, are presented. Variations of the turbulence parameters are studied within and above the surface layer. GRA

N76-20787# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE NO. 3, SUMMARY REPORT 1974

John M. Miller Aug. 1975 113 p refs
(PB-246961/7; NOAA-75103102) Avail: NTIS HC$5.50 CSCL 04A

Geophysical Monitoring Program data for 1974 are included. Ozone, both surface concentrations and total amounts, carbon dioxide, chlorofluorocarbons, and aerosols were monitored. The 1974 carbon dioxide measurements show that the 1973-74 increase in annual concentration is the smallest of the decade dropping at Barrow, Mauna Loa, South Pole, and Cape Matatula (partial 7 month record) from more than 1.5 ppm per year to less than 0.5 ppm per year. It is known that the year-to-year increase is variable and thus it remains to be determined if the small 1973-74 increase was a statistical anomaly or due to physical changes. All of the Antarctic surface ozone data collected over the last 13 years have been assembled and put in computer acceptable form. Also identified were areas where either further work or new instruments or both are necessary to obtain the data quality needed. GRA

N76-20788# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.
PRECIPITATION ANALYSIS FOR BOMEX PERIOD 3
M. D. Hudlow and W. D. Scherer Sep. 1975 46 p refs
(PB-246870/0; NOAA-TR-EDS-13; NOAA-75102301) Avail: NTIS HC $4.00 CSCL 04B

Radar, satellite, and rain-gage data are used qualitatively and quantitatively to describe the precipitation morphology for 10 days (June 21-30, 1969) of Period III of the Barbados Oceanographic and Meteorological Experiment (BOMEX). Typical satellite and radar photographs are presented to illustrate cloud patterns and precipitation echoes for both 'undisturbed' and 'disturbed' weather. Undisturbed conditions are shown to prevail for 5 consecutive days and moderately disturbed conditions for 2 days. Procedures for calibrating and optimizing the use of the quantitative radar data are discussed. Satellite cloud data are used to extrapolate the rainfall estimates to areas not covered by radar. The quantitative rainfall computations gave average rainfall rates over the BOMEX square (250,000 sq km) of 0.35 mm/day and 3.7 mm/day for the 2-day undisturbed and 2-day disturbed periods, respectively. GRA

N76-20789# National Center for Atmospheric Research, Boulder, Colo. Atmospheric Technology Div.
DATA SETS FOR METEOROLOGICAL RESEARCH
Roy L. Jenne Jul. 1975 191 p refs Sponsored by NSF
(PB-246564/9; NCAR-TN/IA-111) Avail: NTIS HC $7.50 CSCL 04B

Various data sets for meteorological and oceanographic research are presented. A few details about the data are provided, but generally voluminous information such as detailed methods and station lists are avoided. Given this general information about various data sets, people can more quickly approach a specific data bank to satisfy their needs. The NCAR has an extensive set of grid point data. Their set of upper-air synoptically filed observed data is also fairly complete. Other types of data are usually in more complete sets at NOAA's National Climatic Center. Since NCAR has data from other sources than NCC and because data are often reformulated in a way that may be convenient for other groups, NCAR makes its data available as a service to members of the research community. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-20790*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
ON THE RECOVERY OF GRAVITY ANOMALIES FROM HIGH PRECISION ALTIMETER DATA
D. Leigemann Feb. 1976 57 p refs
(Grant NGR-36-008-161; OSURF Proj. 3210)
(NASA-CR-146563; Rept-239) Avail: NTIS HC $4.50 CSCL 08J

A model for the recovery of gravity anomalies from high precision altimeter data is derived which consists of small correction terms to the inverse Stokes' formula. The influence of unknown sea surface topography in the case of meandering currents such as the Gulf Stream is discussed. A formula was derived in order to estimate the accuracy of the gravity anomalies from the known accuracy of the altimeter data. It is shown that for the case of known harmonic coefficients of lower order the range of integration in Stokes inverse formula can be reduced very much. Author

N76-20791# New York City-Rand Inst.
A WATER-QUALITY SIMULATION MODEL FOR WELL MIXED ESTUARIES AND COASTAL SEAS. VOLUME 2: A HINDCAST
Jan J. Leendertse Jul. 1975 392 p refs
(R-1774-NYC) Avail: NTIS HC $10.75

A hindcast of post-rainstorm coliform bacteria distributions in Jamaica Bay made by use of a water-quality simulation model of that bay and models of the surrounding drainage basins on the basis of tide, wind, and rainfall data is described and compared with coliform estimates obtained by field sampling. The estimates obtained by simulation agree well with the estimates from field data. It is concluded that the models used here are capable of making predictions for engineering assessments. Author

N76-20792# Deutsches Hydrographisches Institut, Hamburg (West Germany).
RESEARCH SHIP METEOR OF THE GERMAN RESEARCH SOCIETY AND THE GERMAN HYDROGRAPHICAL INSTITUTE. VOYAGE NO. 33 (15 JANUARY - 5 APRIL 1974) ATLANTIC OCEAN - MEDITERRANEAN
[1975] 111 p In GERMAN and ENGLISH Sponsored by Deut. Forschungsgemeinschaft
Avail: NTIS HC $5.50

The voyage was divided into two sections, each with different scientific aims. In the Atlantic, in the region of the Iberian Basin, and in the Western Mediterranean, radiological oceanographical investigations were carried out; in the eastern Mediterranean - north of Crete - geophysical-geological investigations. The disposition of wastes and the spreading of pollutants in seawater was studied in the Atlantic. The question of which seismical crust construction is present in the sea area north of Crete was investigated, together with a possible correlation between the anomalous crust construction of the Ionian and Tyrrhenian Seas. ESA

N76-20793# Naval Postgraduate School, Monterey, Calif.
A NUMERICAL MODEL FOR THE EFFECT OF OCEAN WAVES ON THE ADJACENT AIRFLOW Final Report
A. L. Schoenstadt, R. T. Williams, K. L. Davidson, B. C. Stauffer, and K. G. Dunning Oct. 1975 30 p refs
(AD-A017069; NPS-53ZH75102) Avail: NTIS CSCL 20/4

In 1970, Yefimov proposed a linearized model for predicting the effect of water waves on the adjacent wind flow. The authors investigate the impact of the non-linear terms neglected in his model. In this investigation, the sea surface is described by a single harmonic in x and the wave induced motion in the atmosphere is restricted to this harmonic. Buoyancy effects are neglected and the turbulent fluxes of momentum are approximated in terms of an eddy viscosity. The equations are integrated numerically until a steady-state is achieved. These solutions show that the nonlinear terms which were neglected by Yefimov are important, and that they generally lead a smaller response. The numerical solutions for the mean wind are compared with observations obtained by Davidson and Brutsaert. Although the numerical solutions show some local agreement with the observations, the general behavior is at variance with the observations. GRA

N76-20794# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET MATERIAL ON INTERNAL WAVES, NUMBER 4, JANUARY - MAY 1975
Stuart G. Hibben, L. H. Boylan, and M. Ness 6 Jun. 1975 22 p refs
(Contract N00600-75-C-0018; DARPA Order 2790)
(AD-A010858) Avail: NTIS CSCL 08/3

This is the fourth bibliography of Soviet open-source publications relating to internal wave studies. It covers material received from January through May 1975. Main selection criteria

are studies of small-scale variation in ocean parameters and of airborne techniques for deducing internal wave conditions. An index of serial source abbreviations is appended. GRA

N76-20567* California Univ., La Jolla.
OCEAN TIDES
M. C. Hendershott *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 7-17 refs Repr. from Conf. Proc. E(Earth)S, v. 54, no. 2, Feb. 1973 Sponsored in part by Office of Naval Res. (For availability see N76-20566 11-42)
CSCL 08C

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-20795*+ George Washington Univ., Washington, D.C. Dept. of Medical and Public Affairs.
SCIENTIFIC PUBLICATIONS AND PRESENTATIONS RELATING TO PLANETARY QUARANTINE. VOLUME 5: THE 1975 SUPPLEMENT
Frank D. Bradley Apr. 1976 35 p
(Contract NASw-2890)
(NASA-CR-146562; GWU-SCD-76-5P-Vol-5-Suppl) Avail: NTIS HC $4.00 CSCL 06M

Documents pertaining to planetary quarantine are listed. An author index is given along with a listing of books and journals containing related material. J.M.S.

N76-20796*# Kanner (Leo) Associates, Redwood City, Calif.
CALCULATION OF MUSCULAR POWER IN FLAPPING FLIGHT OF BIRDS FROM KINEMATIC AND MORPHOLOGICAL DATA (STUDIES ON BIOPHYSICS AND PHYSIOLOGY OF AVIAN FLIGHT 3)
H. Oehme Washington NASA Mar. 1976 54 p refs Transl. into ENGLISH from Zool. Jahrb., Abt. Allgem. Zool. Physiol. Tiere (East Germany), v. 79, no. 3, 1975 p 425-458
(Contract NASw-2790)
(NASA-TT-F-16902) Avail: NTIS HC $4.50 CSCL 06C

An airscrew-type calculation is employed to determine the power output of birds' pectoral muscles in level flight, without recourse to aerodynamic force coefficient. Downstroke power is derived from required lift, point of application of tangential force along wing, and angular velocity. Kinematic data (duration of downstroke, duration of accelerated rotation at start of downstroke, and duration of total cycle, flight speed, stroke angle, stroke angle bisector) are obtained from films. Sample flights of pigeons and doves are analyzed, and compared with metabolic-physiological results, confirming the usability of this method. In both species, the power output per unit weight of the pectoral muscles (0.26-0.60 HP/kg) under prolonged load is 10 to 20 times that of mammalian muscles, except, probably, for the flight muscles of bats. Author

N76-20797*# Martin Marietta Corp., Denver, Colo.
UREA/AMMONIUM ION REMOVAL SYSTEM FOR THE ORBITING FROG OTOLITH EXPERIMENT Final Report
Jon R. Schulz and Robert T. Anselmi Jan. 1976 123 p refs
(Contract NAS2-8165)
(NASA-CR-137833; MCR-76-6) Avail: NTIS HC $5.50 CSCL 06C

The feasibility of using free urease enzyme and ANGC-101 ion exchange resin to remove urea and ammonium ion for space system waste water applications was studied. Specifically examined is the prevention of urea and ammonia toxicity in a 30-day Orbiting Frog Otolith (OFO) flight experiment. It is shown that free urease enzyme used in conjunction with ANGC-101 ion-exchange resin and pH control can control urea and amonium ion concentration in unbuffered recirculating water. In addition, the resin does not adversely effect the bullfrogs by lowering the concentration of cations below critical minimum levels. Further investigations on bioburden control, frog waste excretion on an OFO diet, a trade-off analysis of methods of automating the urea/ammonium ion removal system and fabrication and test of a semiautomated breadboard were recommended as continuing efforts. Photographs of test equipment and test animals are shown. Author

N76-20798*# Missouri Univ., Columbia. Dalton Research Center.
THE ROLE OF DEPRESSED METABOLISM IN INCREASED RADIO-RESISTANCE Semiannual Status Report
X. J. Musacchia Mar. 1975 43 p refs
(Grant NGL-26-004-021)
(NASA-CR-146512) Avail: NTIS HC $4.00 CSCL 06C

The results of experiments on hamsters and rats to determine physiological responses to various temperature conditions are presented. The experimental methods described are considered to be applicable to future mammalian experiments in space. Renal function was examined in the golden hamster as a function of body temperature. Hamsters were also acclimated to heat and metabolic rates, body temperature, skin temperature, cardiac distribution and whole body hematocrits were measured. In addition, the effects of heat stress on the intestinal transport of sugars in the hamster and rat were studied. The biological effects of prolonged space flight and methods of simulating weightlessness are also discussed. D.M.L.

N76-20799*# Hardin-Simmons Univ., Abilene, Tex. Science Research Center.
RESPONSE OF SELECTED MICROORGANISMS TO EXPERIMENTAL PLANETARY ENVIRONMENTS Semiannual Progress Report, 1 Jul. - 31 Dec. 1975
Terry L. Foster, S. J. S. Helms, L. E. Kirschner, W. C. Stevens, L. K. Talley, and L. Winans, Jr. Feb. 1976 42 p refs
(Grant NGR-44-095-001)
(NASA-CR-146666; SAPR-7) Avail: NTIS HC $4.00 CSCL 06M

The anaerobic utilization of phosphite or phosphine and the significance of this conversion to potential contamination of Jupiter were investigated. A sporeforming organism was isolated from Cape Canaveral soil which anaerobically converts hypophosphite to phosphate. This conversion coincides with an increase in turbidity of the culture and with phosphate accumulation in the medium. Investigations of omnitherms (organisms which grow over a broad temperature range, i.e. 3 -55 C were also conducted. The cellular morphology of 28 of these isolates was investigated, and all were demonstrated to be sporeformers. Biochemical characterizations are also presented. Procedures for replicate plating were evaluated, and those results are also presented. The procedures for different replicate-plating techniques are presented, and these are evaluated on the basis of reproducibility, percentage of viable transfer, and ease of use. Standardized procedures for the enumeration of microbial populations from ocean-dredge samples from Cape Canaveral are also presented. Author

N76-20800*# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANIMAL EXPOSURE DURING BURN TESTS Final Report
James G. Gaume Jan. 1976 64 p refs
(Contract NAS2-8668)
(NASA-CR-137802; MDC-J7133) Avail: NTIS HC $4.50 CSCL 06C

An animal exposure test system has been designed and fabricated for the purpose of collecting physiological and environmental (temperature) data from animal subjects exposed to combustion gases in large scale fire tests. The AETS consists of an open wire mesh, two-compartment cage, one containing an exercise wheel for small rodents, and the other containing one rat instrumented externally for electrocardiogram and respiration. The ECG and respiration sensors are located in a belt placed around the torso of the subject, electrode wires forming an umbilical to a connector in the top of the compartment. A cable extends from the connector to the power supply and signal conditioning electronics. These are connected to a dual-beam oscilloscope for real time monitoring and a magnetic tape recorder having three or more channels. Endpoints observed are bradycardia, cardiac arrhythmias, changes in respiratory pattern, respiratory arrest and cardiac arrest. The ECG record also appears to be a good method of monitoring animal activity as indicated by an increase in EMG noise superimposed on the record during increased activity of the torso musculature. Examples of the

recordings are presented and discussed as to their significance regarding toxicity of fire gases. Author

N76-20801*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEURAL CODING OF HIGH-FREQUENCY TONES
Walton L. Howes Washington Mar. 1976 9 p refs
(NASA-TM-X-3374; E-8607) Avail: NTIS HC $3.50 CSCL 05E

Available evidence was presented indicating that neural discharges in the auditory nerve display characteristic periodicities in response to any tonal stimulus including high-frequency stimuli, and that this periodicity corresponds to the subjective pitch. Author

N76-20802*# Missouri Univ., Columbia.
[STRESS, TEMPERATURE, HEART RATE, AND HIBERNATING FACTORS IN HAMSTERS] Annual Status Report
X. J. Musacchia Aug. 1974 109 p refs
(Grant NGL-26-004-021)
(NASA-CR-146665) Avail: NTIS HC $5.50 CSCL 06C

Pathophysiological conditions resulting from prolonged exposure to zero gravity, cabin constraint, altered ambient environment, whether it be noise, vibrations, high temperatures, or combinations of such factors, are studied in laboratory animals and applied to manned space flight. Results and plans for further study are presented. Specific topics covered include: thermoregulation and its role in reflecting stress and adaptation to the gravity free environment and cabin confinement with its altered circadian forcings; renal function and its measurement in electrolyte distribution and blood flow dynamics; gastronintestinal function and an assessment of altered absorptive capacity in the intestinal mucosa; and catecholamine metabolism in terms of distribution and turnover rates in specific tissues. J.M.S.

N76-20803*# Missouri Univ., Columbia.
[HIBERNATION, STRESS, INTESTINAL FUNCTIONS, AND CATECHOLOAMINE TURNOVER RATE IN HAMSTERS AND GERBILS] Annual Status Report
X. J. Musacchia Aug. 1973 25 p refs
(Grant NGL-26-004-021)
(NASA-CR-146662) Avail: NTIS HC $3.50 CSCL 06C

Bioenergetic studies on hamsters during depressed metabolic states are reported. External support of blood glucose extended the survival times of hibernating animals. Radioresistance increased in hibernating as well as in hypothermic hamsters. Marked changes in hamster catecholamine turnover rates were observed during acclimatization to high temperature stress. High radioresistance levels of the gerbil gastrointestinal system were attributed in part to the ability of the gut to maintain functional integrity. G.G.

N76-20804# Massachusetts Univ., Amherst. Dept. of Chemical Engineering.
THE DETERMINATION OF MASS TRANSFER LIMITATIONS IN AN IMMOBILIZED ENZYME PLUG FLOW REACTOR M.S. Thesis
Bruno J. Rovito 7 Apr. 1972 95 p refs Sponsored by NSF
(PB-246123/4; NSF/RA/T-72-043) Avail: NTIS HC $5.00 CSCL 07D

Enzymes are protein molecules which are found in all living organisms and are natural catalysts. One would envision wide industrial use of enzymes to accomplish various reactions. In recent years, a promising approach has been developed to circumvent some problems with enzymes. They have been immobilized whereby they are rendered water insoluble. Covalent bonding to a support, appears most promising and was used in this research study. The advantages of immobilized enzymes over the soluble variety as well as the characteristics of enzymes in general would indicate a bright future in commercial operations, provided some preliminary work is carried out on laboratory equipment to further explore and continue to define the behavior of immobilized enzymes in flow reactors. The objective of the research was the evaluation and selection of alternative models for film and pore mass transfer applied to the use of immobilized enzymes in a plug flow reactor. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-20805* + National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 151
Feb. 1976 63 p
(NASA-SP-7011(151)) Avail: NTIS HC $4.00 (special price) CSCL 06E

This bibliography lists 195 reports, articles, and other documents introduced into the NASA scientific and technical information system in January 1976. Author

N76-20806*# Transemantics, Inc., Washington, D.C.
BODY TEMPERATURE FLUCTUATION AND HYPOTHALAMIC TEMPERATURE SENSIBILITY
L. P. Dymnikova and K. P. Ivanov Washington NASA Mar. 1976 15 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 55, no. 3, 1969 p 295-300
(Contract NASw-2792)
(NASA-TT-F-16978) Avail: NTIS HC $3.50 CSCL 06P

The reasons for the occurance of body temperature fluctuations were studied. Body temperature in man and animals can change in various physiological states. These changes are explained by variations in heat production of a shift of the fixed point of the physiological heat regulator. Precise measurements of the temperature of the hypothalamus and several other areas of the brain, arterial blood, and skin were conducted in rabbits under chronic experimental conditions. Author

N76-20807*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADAPTATION TO PROLONGED BEDREST IN MAN: A COMPENDIUM OF RESEARCH
John E. Greenleaf, Carol J. Greenleaf, Dena VanDerVeer, and Karen J. Dorchak Washington Mar. 1976 183 p refs
(NASA-TM-X-3307; A-6040) Avail: NTIS HC $7.50 CSCL 06S

A compilation of major studies that describe the clinical observations and elucidate the physiological mechanisms of the adaptive process of man undergoing prolonged bed rest is presented. Additional studies are included that provide background information in the form of reviews or summaries of the process. Wherever possible a detailed annotation is provided under the subheadings: (1) purpose, (2) procedure and methods, (3) results, and (4) conclusions. Additional references are provided in a selected bibliography. Author

N76-20808*# Scientific Translation Service, Santa Barbara, Calif.
THE DEVELOPMENT OF THE VESTIBULAR APPARATUS UNDER CONDITIONS OF WEIGHTLESSNESS
Ya. A. Vinnikov, O. G. Gazenko, L. K. Titova, A. A. Bronshteyn, V. I. Govardovskiy, R. A. Pevzner, F. G. Gribakin, M. A. Aronova, T. A. Kharkeyevich, and T. P. Tsirulis Washington NASA Apr. 1976 11 p refs Transl. into ENGLISH from Arkh. Anat., Gistol. i Embriol. (USSR), v. 70, no. 1, 1976 p 11-16 Presented at COSPAR meeting, Varna, Bulgaria, Jun. 1975
(Contract NASw-2791)
(NASA-TT-F-16987) Avail: NTIS HC $3.50 CSCL 06P

The vestibular apparatus was studied in embryos of fishes and frogs in which the vestibular apparatus was still absent when they were launched into space. Electron microscope studies showed that the auditory vesicle with macula communis was indistinguishable from the controls. However development of the otoliths and otolithic membranes showed significant deviations under weightlessness conditions. Author

N76-20809# Oak Ridge National Lab., Tenn.
RADIATION MONITORING, AUGUST 1975 Annual Report, 1974
Aug. 1975 69 p Sponsored by ERDA
(ORNL-5055) Avail: NTIS

There were no external or internal exposures to personnel of ORNL which exceeded the standards for radiation protection

as defined in ERDA Manual Chapter 0524. Only 41 employees received exposures greater than 1 rem. The highest whole body exposure dose equivalent to an employee was 3.58 rem. The highest internal exposure was less than one half of the maximum permissible body burden. During 1974, 20 portable instruments were added to the inventory and nine retired. The total number in service on January 1, 1975, was 1,294. There were 22 facility radiation monitoring instruments installed and 21 retired during 1974. The total number in service on January 1, 1975, was 983. Author (NSA)

N76-20810# Massachusetts General Hospital, Boston.
SORPTION AND RETENTION OF SUBSTANCES IN THE SURFACE LAYERS OF THE SKIN Final Technical Report, Jan. 1972 - Nov. 1974
Robert J. Scheuplein Feb. 1975 129 p refs
(Contract DAHC19-72-G-0014)
(AD-A009792; ARO-11706.1-L) Avail: NTIS CSCL 06/16

The sorption and desorption behavior of various compounds into and out of human skin was studied using an in vitro techniques. Aqueous solutions of radio actively tagged electrolytes were applied to the surface of intact specimens of epidermis and the sorption and desorption of these solutes by the stratum corneum was measured. Analysis of the equilibrium sorption data gave diffusion constants, values of partition coefficients and thermodynamic quantities, e.g., enthalpies of sorption. Water, alcohols, glycols, phenos, esters and assorted other nonelectrolytes were studied. The sorption of water was found to have a large effect on the structure of the stratum corneum leading to increased sorption capacity and greater diffusivity of the tissue for other subsequently applied substances. GRA

N76-20811# Colorado State Univ., Fort Collins.
TRANSMURAL QUANTITATIVE MEASUREMENT OF BLOOD FLOW Final Report
Michael B. Histand and Charles W. Miller Jun. 1975 39 p refs
(Grant NSF GK-41227)
(PB-246822/1; NSF-31-1374-3074) Avail: NTIS HC $4.00 CSCL 06P

A pulsed ultrasound Doppler velocity meter was evaluated for quantitative transmural and transcutaneous measurement of blood flow. Experiments were performed for highly controlled flow conditions in long, straight segments of dialysis tubing and in vivo in canines. The authors were able to clearly demonstrate the high degree of accuracy of the PUDVM for measuring flow and velocity when the transducer and electronic gate were less than half the vessel radius. Also the high correlation between transcutaneous measurements of blood velocity and values obtained with cuffs implanted directly on the vessel was shown. GRA

N76-20812# Bureau of Radiological Health, Rockville, Md.
MEDICAL X-RAY PHOTO-OPTICAL SYSTEMS EVACUATION SYMPOSIUM
David J. Goodenough and Robert F. Wagner Oct. 1975 256 p refs Symp. held at Columbia, Md., 21-23 Oct. 1974
(Contract FDA-223-74-6119)
(PB-246946/8; DHEW/FDA-76-8020) Avail: NTIS HC $9.00 CSCL 06L

Quality control procedures are developed to assure optimal and reproducible application of the best technology. The meeting of experts from diverse circumstances - radiologists, medical physicists, members of standards institutes, scientists, industry, U.S. and foreign associations, researchers and other responsible scientists met to improve the diagnostic quality of images formed from medical X-rays. Lowering the X-ray dose requirements, and discovering ways to make the best and safest technology available to the consumer community were discussed. GRA

N76-20813# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEIGHTLESS ORBIT
Boris Konovalov 6 May 1975 12 p refs Transl. into ENGLISH from Izvestiya (USSR), no. 34/17877, 9 Feb. 1975 p 3
(AD-A017199; FTD-ID(RS)I-1325-75) Avail: NTIS CSCL 06/19

The monitoring of the flight of Salyut-4 is reported. The spaceship includes a multipurpose laboratory which studies astrophysics, the universe, the earth's surface, its natural resources, and biological and medical experiments. GRA

N76-20814# Duke Univ., Durham, N.C. Dept. of Ophthalmology.
LASER EXPOSURES IN THE MACULAS OF HUMAN VOLUNTEERS Final Report
M. L. Wolbarsht and M. B. Landers, III 30 Sep. 1975 46 p refs
(Contract N00014-67-A-0251-0011)
(AD-A017507) Avail: NTIS CSCL 06/18

Patients whose eyes require enucleation for medical reasons were exposed to focused argon laser beams in a regular pattern of locations in the eye, especially in the macula, including the fovea. The power levels were suprathreshold to just produce instantaneous lesions. The ophthalmoscopic appearance of the resultant lesions was correlated with loss of function and with subsequent histological examination. An argon laser lesion in the macula may have greater functional impairment than a comparable ruby laser lesion. In lesions outside the macula the damage is confined to the retinal pigment epithelium and adjacent structures. In markedly suprathreshold lesions the outer segments of the rods were less disturbed than the inner nuclear and plexiform layers. Within the macula there are usually two damage locations separated by unchanged layers of the retina. In the pigment epithelium in which the damage was the same or less than in lesions outside the macula, there was a larger area of damage in the outer plexiform layer. Foveal lesions had greater damage to the fiber layer of Henle (outer plexiform layer) than in adjacent areas of the macula at comparable power levels. GRA

N76-20815# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.
DOSE-RATE EFFECTS OF Co60 IRRADIATION
A. Bruner, V. Bogo, and E. A. Henderson 30 Jul. 1975 84 p refs
(Contracts DASA01-70-C-0059; DNA001-74-C-0098; DNA Proj. NWED-QAXMA191)
(AD-A017505; DNA-3660T) Avail: NTIS CSCL 06/18

One thousand rad Co60 was administered to 12 monkeys at 75 rad/min and to 8 monkeys at 50 rad/min while they performed a delayed match-to-sample, shock avoidance task. Only four at 75 rad/min and two at 50 rad/min showed early performance decrement and/or early transient incapacitation (PD-ETI), in contrast to 13 of 16 previously studied monkeys who showed PD-ETI with an average dose rate of 180 rad/min. A dose-rate effect was concluded. When these three groups were compared with an untrained group exposed to a 4,000-rad gamma-neutron pulse, all showed similar degrees of hypotension postirradiation. But the onset of hypotension was delayed and its rate of fall prolonged as dose rate decreased. Tentative interpretation was that radiation thresholds for the induction of PD-ETI exist for cumulative dose ($>$ or $=$ 300 rad midbody) and dose rate ($>$ or $=$ 30 rad/min). GRA

N76-20816# Office of Naval Research, London (England).
CURRENT RESEARCH ON NATURAL MEMBRANES Report for period ending Aug. 1975
Martin Blank 11 Sep. 1975 23 p
(AD-A017548; ONRL-15-75) Avail: NTIS CSCL 06/16

In recent years, there have been important advances in understanding of the structure and functions of natural membranes. This report summarizes and assesses the general state of research on the subject with the emphasis on developments in Europe. The author's perspective, which was formed during the past year as a result of visiting labs and talking to scientists, includes a recognition of the role of various paradigms in membrane research, and a change in the conception of molecular movements in membranes as a result of the introduction of 'fluidity' measurements. The report summarizes these ideas and provides a general overview of recent specific research developments in Europe. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-20817*# AiResearch Mfg. Co., Los Angeles, Calif.
OBJECTIVE TECHNIQUES FOR PSYCHOLOGICAL ASSESSMENT, PHASE 2 Final Report
E. C. Wortz, A. J. Saur, D. P. Nowlis, and M. P. Kendall 30 Aug. 1974 199 p refs
(Contract NAS9-12771)
(NASA-CR-147512; AiResearch-74-10681) Avail: NTIS HC $7.50 CSCL 05J

Results are presented of an initial experiment in a research program designed to develop objective techniques for psychological assessment of individuals and groups participating in long-duration space flights. Specifically examined is the rationale for utilizing measures of attention as an objective assessment technique. Subjects participating in the experiment performed various tasks (eg, playing matrix games which appeared on a display screen along with auditory stimuli). The psychophysiological reactions of the subjects were measured and are given. Previous research of various performance and psychophysiological methods of measuring attention is also discussed. The experiment design (independent and dependent variables) and apparatus (computers and display devices) are described and shown. Conclusions and recommendations are presented. Author

N76-20818# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
QUANTIFICATION AND PREDICTION OF HUMAN PERFORMANCE: SEQUENTIAL TASK PERFORMANCE RELIABILITY AND TIME Final Report
Robert G. Mills, Robert F. Bachert, and Shirley A. Hatfield Aug. 1975 37 p refs
(AF Proj. 7184)
(AD-A017333; AMRL-TR-74-48) Avail: NTIS CSCL 05/10

A methodology has been developed and an experiment conducted to examine some of the assumptions and combinatorial rules employed in applying human performance reliability (HPR) and task time data to the quantification of human performance. Subjects performed a variety of tasks designed to provide empirical estimates of HPR and task time and to permit examination of the effects of combining tasks. Results indicated (a) the normality assumption for distribution of task time is inappropriate, (b) the rules for combining task times are satisfactory if the underlying distribution of task times is known, (c) HPR is affected severely by combining tasks, and (d) any model for estimating HPR will require parameters to account for task combining and difficulty. GRA

N76-20819# Life Sciences, Inc., Hurst, Tex.
AFHRL/FT CAPABILITIES IN UNDERGRADUATE PILOT TRAINING SIMULATION RESEARCH: EXECUTIVE SUMMARY Final Report, Aug. 1974 - Mar. 1975
W. G. Matheny, T. H. Gray, and B. K. Waters Aug. 1975 33 p refs
(Contract F41609-73-C-0038; AF Proj. 1123)
(AD-A017168; LSI-TR-74-2; AFHRL-TR-75-26(1); AFHRL-TR-75-26(2)) Avail: NTIS CSCL 05/9

This report describes: (1) The research capabilities of AFHRL/FT, with particular emphasis upon the advanced simulator for undergraduate pilot training (ASUPT); (2) Results of a prioritization of potential flying research issues by a panel of experts; (3) Contractor recommendations for initial AFHRL/FT experimental investigations, and (4) the AFHRL/FT facility utilization program for calendar year 1975. The concept of 'performance equivalence' between simulator and aircraft is presented along with a description of suggested studies designed to validate the concept. Utilization of automated performance measures on both system outputs and pilot control inputs forms an essential element of the model. GRA

N76-20820# Naval Postgraduate School, Monterey, Calif.
AN ANALYSIS OF AGE AND PERFORMANCE AMONG COMMUNICATIONS PERSONNEL M.S. Thesis
James M. Carter Sep. 1975 60 p refs
(AD-A017536) Avail: NTIS CSCL 05/10

This thesis utilized longitudinal and performance appraisal information on 182 naval telecommunications personnel from two Naval Communication Stations and an Attack Carrier to develop a career development model and high performance characteristics. High correlation between age and paygrade, mean time between advancements, and years since last advancement; and weak correlation between age and job index, and evaluation scores were noted. When scored on an all or nothing basis the 31-36 year age-group received a significantly higher mean score on the evaluation questionnaire than the 37-42 year age-group. This may be interpreted as early low performance among the personnel sampled for this study. Author (GRA)

N76-20821# Naval Postgraduate School, Monterey, Calif.
HUMAN PERFORMANCE OF BIORHYTHMS M.S. Thesis
William Wilson Cobb, Jr. Sep. 1975 42 p refs
(AD-A017537) Avail: NTIS CSCL 05/10

Using a serial memory task, human performance and biorhythms were studied in the laboratory for a fifteen week period. The purpose of the experiment was to determine whether dependency between human performance and biorhythmic cycles existed for the subjects observed. Analysis of the data using the Chi-Square Contingency Test collected from 4 subjects showed a significant dependency at the .05 level existed between 2 of 3 biorhythmic cycles and human performance as well as near significant dependency existing for the third cycle and human performance. Further analysis using the X squared one sample test showed no significance between critical days and categories of performance at the .05 level. Author (GRA)

N76-20822# Stanford Research Inst., Menlo Park, Calif.
FEASIBILITY STUDY FOR DESIGN OF A BIOCYBERNETIC COMMUNICATION SYSTEM Final Technical Report
Lawrence R. Pinneo, Patricia Johnson, Jennine Herron, and Charles S. Rebert Aug. 1975 157 p refs
(Contract DAHC15-72-C-0167; ARPA Order 2034; SRI SRI Proj. LSU-1936)
(AD-A017405) Avail: NTIS CSCL 05/8

The purpose of this three-year research program was to test the feasibility of designing a close-coupled, two-way communication link between man and computer using biological information from muscles of the vocal apparatus and the electrical activity of the brain during overt and covert (verbal thinking) speech. The research plan was predicated on existing evidence that verbal ideas or thoughts are subvocally represented in the muscles of the vocal apparatus. If the patterns of this muscle activity are at all similar to those involved in normal overt speech, a reasonable assumption is that the electrical activity of the brain during verbal thinking may be similar to that during overt speech. The results are reported in two parts. Part I concerns the off-line and on-line analysis of the EEG coincident with overt and covert speech as it might be used in biocybernetic communication, and Part II concerns the hemispheric laterality difference. GRA

N76-20823*# Stanford Univ., Calif.
BIOCYBERNETIC FACTORS IN HUMAN PERCEPTION AND MEMORY Final Report
David C. Lai Sep. 1975 112 p refs
(Grant NGR-05-020-575; Contract DAHC15-72-C-0232)
(NASA-CR-146557; AD-A017374; SU-SEL-75-021) Avail: NTIS HC $5.50 CSCL 06/2

The objective of this research is to develop biocybernetic techniques for use in the analysis and development of skills required for the enhancement of concrete images of the 'eidetic' type. The scan patterns of the eye during inspection of scenes are treated as indicators of the brain's strategy for the intake of visual information. The authors determine the features that differentiate visual scan patterns associated with superior imagery from scan patterns associated with inferior imagery, and simultaneously differentiate the EEG features correlated with superior imagery from those correlated with inferior imagery. A closely-coupled man-machine system has been designed to generate image enhancement and to train the individual to exert greater voluntary control over his own imagery. The models for EEG signals and saccadic eye movement in the man-machine

system have been completed. The report describes the details of these models and discusses their usefulness. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-20824*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF CORRELATION BETWEEN PILOT SCANNING BEHAVIOR AND WORKLOAD USING STEPWISE REGRESSION ANALYSIS
Marvin C. Waller Washington Mar. 1976 22 p refs
(NASA-TM-X-3344; L-10566) Avail: NTIS HC $3.50 CSCL 05E

An electro-optical device called an oculometer which tracks a subject's lookpoint as a time function has been used to collect data in a real-time simulation study of instrument landing system (ILS) approaches. The data describing the scanning behavior of a pilot during the instrument approaches have been analyzed by use of a stepwise regression analysis technique. A statistically significant correlation between pilot workload, as indicated by pilot ratings, and scanning behavior has been established. In addition, it was demonstrated that parameters derived from the scanning behavior data can be combined in a mathematical equation to provide a good representation of pilot workload. Author

N76-20825*# Rockwell International Corp., Los Angeles, Calif. Aircraft Div.
RIDE QUALITIES CRITERIA VALIDATION/PILOT PERFORMANCE STUDY: FLIGHT SIMULATOR RESULTS Final Report
Louis U. Nardi, Harry Y. Kawana, Christopher J. Borland, and Norman M. Lefritz Mar. 1976 101 p refs
(Contract NAS4-2236)
(NASA-CR-143838; H-936) Avail: NTIS HC $5.50 CSCL 05E

Pilot performance was studied during simulated manual terrain following flight for ride quality criteria validation. An existing B-1 simulation program provided the data for these investigations. The B-1 simulation program included terrain following flights under varying controlled conditions of turbulence, terrain, mission length, and system dynamics. The flight simulator consisted of a moving base cockpit which reproduced motions due to turbulence and control inputs. The B-1 aircraft dynamics were programmed with six-degrees-of-freedom equations of motion with three symmetric and two antisymmetric structural degrees of freedom. The results provided preliminary validation of existing ride quality criteria and identified several ride quality/handling quality parameters which may be of value in future ride quality/criteria development. Author

N76-20826# School of Aerospace Medicine, Brooks AFB, Tex.
THE C-141 THERAPEUTIC OXYGEN MANIFOLD DISTRIBUTION SYSTEM Final Report, Sep. 1972 - Jul. 1974
Paul C. Baker Aug. 1975 7 p
(AF Proj. 7996)
(AD-A015740; SAM-TR-75-31) Avail: NTIS CSCL 06/11

The C-141 Therapeutic Oxygen Manifold System was developed to overcome deficiencies of the integral C-141 therapeutic oxygen system. Three functional units, fabricated in-house to meet design specifications and performance requirements, successfully passed all phases of DT and E; no changes were made to the hardware. Two units were made available to Military Airlift Command for Operational Test and Evaluation (OT/E). OT/E results indicated that the units were acceptable for routine use aboard C-141 aeromedical airlift missions and were a definite improvement over the integral therapeutic oxygen system. Author (GRA)

N76-20827# National Bureau of Standards, Washington, D.C. Center for Fire Research.
DESIGN CRITERIA FOR FIREFIGHTERS' TURNOUT COATS Final Report
J. W. Eisele Oct. 1975 38 p Sponsored in part by Natl. Fire Prevention and Control Admin.
(COM-75-11433/0; NBSIR-75-702) Avail: NTIS HC $4.00 CSCL 06Q

The design criteria cover requirements for the sizing, construction, outer shell, inner linings, weight and thickness for firefighters' turnout coats as well as test methods, labeling requirements and design considerations. Included also is a list of options and other items of concern to potential users of the criteria and a sample purchase specification to be used in conjunction with the criteria. GRA

N76-20828# Army Aeromedical Research Lab., Fort Rucker, Ala.
THE USE OF OPAQUE LOUVRES AND SHIELDS TO REDUCE REFLECTIONS WITHIN THE COCKPIT: A TRIGONOMETERICAL AND PLANE GEOMETRICAL APPROACH Final Report
Chun K. Park and Frank F. Holly Sep. 1975 23 p refs
(AD-A017366; USAARL-76-4) Avail: NTIS CSCL 05/5

Opaque shields can be used to channel light and thereby reduce reflections within the cockpit. These shielding devices range from the standard glare shield on top of the instrument panel to the more experimental use of Light Control Film and Micromesh for this purpose. Because of the need to determine the best position, width, spacing, etc. of these shielding devices, it was felt that s systematic approach would be highly desirable. This work describes a mathematical analysis to assess the applicability of those devices to resolve aircraft windscreen reflection problems. GRA

N76-20829# Fabric Research Labs., Inc., Dedham, Mass.
EXPLORATORY DEVELOPMENT OF COATED FABRIC FOR FIREFIGHTERS' PROTECTIVE CLOTHING Final Report, 1 Apr. 1974 - 31 Mar. 1975
Norman J. Abbott, T. E. Lannefeld, and R. E. Erlandson Jul. 1975 21 p
(Contract F33615-74-C-5117; AF Proj. 7320)
(AD-A016525; AFML-TR-75-72) Avail: NTIS CSCL 11/5

The objective of the work was to improve the durability of the aluminized fabric currently used for the outer layer of firefighters' proximity coats. Two possible improvements were developed: (a) Substituting a Viton/bronze coating for the aluminum, and adding a topcoat of pigmented urethane to improve wear resistance; (b) Adding a topcoat of pigmented urethane to the aluminized fabric to improve wear resistance. Sample lengths of both types of coated fabric were produced. GRA

N76-20830# Human Factors Research, Inc., Goleta, Calif.
TOWARD A METHODOLOGY FOR MAN-MACHINE FUNCTION ALLOCATION IN THE AUTOMATION OF SURVEILLANCE SYSTEMS. VOLUME 1: SUMMARY Final Technical Report, 8 Mar. 1971 - 12 Dec. 1974
C. Sylie, Robert A. Dick, and Robert R. Mackie 31 Jul. 1975 85 p refs
(Contract N00014-71-C-0301; DARPA Order 1751)
(AD-A017103; TR-1722-F-Vol-1) Avail: NTIS CSCL 05/8

A study was conducted to determine some of the performance implications of various degrees of automation in surveillance systems. The objective was to aid system designers of future surveillance systems in making trade-off decisions. A general functional taxonomy of surveillance systems was developed and each function was considered in terms of the necessity of operator involvement versus the likely success of full automation. A model of human information processing in surveillance systems was developed and various strengths and weaknesses of surveillance system operators were discussed in relation to the elements of the model. GRA

N76-20831# Underwriters Labs., Inc., Tampa, Fla.
INVESTIGATION OF THE PERFORMANCE OF PERSONAL FLOTATION DEVICES Final Report
Aug. 1975 129 p refs
(Contract DOT-CG-25112-A)
(AD-A017101; USCG-D-168-75) Avail: NTIS CSCL 06/7

An experimental investigation was performed to study various

aspects of an existing theory for flotation equilibrium angle of a person wearing a personal flotation device (PFD) in water. The major objectives were determination of the validity of the theory, and derivation of a method for determining the buoyant force and center of buoyancy of a PFD when worn by a person. Additionally, information was obtained on the sensitivity of the theory to small changes in variables, the variability of repetitive measurements of certain human-body characteristics required by the theory (namely, lung vector and intrinsic stiffness vector), the variation with time of day of an individual's intrinsic stiffness vector, and the comparative effectiveness of five PFD's. The experiments used eight human subjects (130-240 lbs. in weight), five PFD's, and five different times of day. Because of the small number of experiments used, the statistical significance of some results is limited. A recommended approach to evaluating PFD effectiveness using experiments with mannequins is described. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N76-20832 Illinois Univ., Urbana.
A NEW CONTROL STRUCTURE FOR SERIALLY ORGANIZED MEMORIES IN AN INTERACTIVE COMPUTER SYSTEM Ph.D. Thesis
Paul Thomas Tucker 1975 126 p
Avail: Univ. Microfilms Order No. 76-6994

One of the problems to be overcome before interactive computer systems can be economically applied to such fields as public education is the need for massive amounts of high performance, inexpensive memory. The feasibility of using massive amounts of serial memory which will eventually be less expensive than random access memory is demonstrated. The use of a highly sophisticated memory controller will cause this serial memory to perform similarly to random access memory in this application. A serial memory having characteristic latency times of hundreds of microseconds will appear to the controlling computer to have average access times of tens of microseconds. To determine this control structure, and to determine the applicability of this memory system to the PLATO computer-based education system, a memory controller and a small memory system were built and operated, and software was written to slave the memory controller system to operation of the PLATO system. Dissert. Abstr.

N76-20833 Illinois Univ., Urbana.
AUTOMATIC CURVE FITTING FOR INTERACTIVE DISPLAY Ph.D. Thesis
Won Lyang Chung 1975 100 p
Avail: Univ. Microfilms Order No. 76-6723

A simple, economical, and reliable automatic graphical data compression algorithm is presented for interactively displaying curves on the screen of CRT-like graphics terminals. An adaptive local scheme based on interpolating piecewise cubic polynomials with continuous slopes was designed and implemented. The scheme accepts a large number of data points as they are generated one point by one by an ordinary differential equations package and compresses the data into a compact picture representation. The important features of this algorithm can be found in its adaptive use of two quantitative measures of approximation--a local least-squares error norm and a pseudo distance norm, and its ability to regenerate aesthetically pleasing curves using the piecewise cubic polynomial interpolants with relatively few knots by one-sided, local computational procedures. The scheme can be used for compression, transmission, and display of graphical data in both on-line and off-line environments. Dissert. Abstr.

N76-20834*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN INTERACTIVE SCENE ANALYSIS Final Report
J. M. Tenenbaum, H. G. Barrow, and S. A. Weyl Jan. 1976 77 p refs
(Contract NASw-2086; SRI Proj. 8721)
(NASA-CR-146667) Avail: NTIS HC $5.00 CSCL 09B

Cooperative (man-machine) scene analysis techniques were developed whereby humans can provide a computer with guidance when completely automated processing is infeasible. An interactive approach promises significant near-term payoffs in analyzing various types of high volume satellite imagery, as well as vehicle-based imagery used in robot planetary exploration. This report summarizes the work accomplished over the duration of the project and describes in detail three major accomplishments: (1) the interactive design of texture classifiers; (2) a new approach for integrating the segmentation and interpretation phases of scene analysis; and (3) the application of interactive scene analysis techniques to cartography. Author

N76-20835# Oak Ridge National Lab., Tenn.
COMPUTER UTILITY FOR INTERACTIVE INSTRUMENT CONTROL
P. Day Aug. 1975 24 p refs Presented at Symp. on Computer Networking and Chem. Chicago, 24 Aug. 1975 Sponsored by ERDA
(Conf-750840-1) Avail: NTIS HC $4.25

A careful study of the ANL laboratory automation needs in 1967 led to the conclusion that a central computer could support all of the real time needs of a diverse collection of research instruments. A suitable hardware configuration would require an operating system to provide effective protection, fast real time response, and efficient data transfer. An SDS Sigma 5 satisfied all hardware criteria, however it was necessary to write an original operating system; services include program generation, experiment control real time analysis, interactive graphics and final analysis. The system is providing real time support for 21 concurrently running experiments, including an automated neutron diffractometer, a pulsed NMR spectrometer and multi-particle detection systems. It quarantees the protection of each user's interests and dynamically assigns core memory, disk space and 9-track magnetic tape usage. Multiplexor hardware capability allows the transfer of data between a user's device and assigned core area at rates of 100,000 bytes/sec. Author (NSA)

N76-20836# Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
HIGH DATA RATE MAGNETIC MEMORY DEVICES Final Report, 6 Jul. 1970 - 30 Apr. 1975
P. K. George, O. D. Bohning, and L. R. Tocci Jul. 1975 85 p refs
(Contract DAAB07-70-C-0258; DA Proj. 1S6-62705-A-57)
(AD-A013510; ECOM-70-0258-F; C75-375/501) Avail: NTIS CSCL 09/2

This report presents the results of a system and cost study made to determine the feasibility of developing a bubble domain BORAM chip using existing device components. Due to the short access time requirements the major-minor loop chip organiza-

tion cannot be used and due to the lack of a decoder of the necessary type with adequate margins, an alternative chip scheme is proposed in which parallel access to storage loops is achieved via separate transfer switches. The feasibility of realizing such a chip is examined from the viewpoint and preliminary designs are proposed. Estimates of the system costs and optimum chip capacity are made based upon a simple yield model for bubble devices. Author (GRA)

N76-20837# Michigan Univ., Ann Arbor. Graduate School of Business Administration.

EVALUATION AND SELECTION OF FILE ORGANIZATION THROUGH ANALYTIC MODELING

S. B. Yao (Purdue Univ.) and A. G. Merten 1975 25 p refs (Contract MDA903-74-C-0300)

(AD-A015934; AFOSR-75-1294TR) Avail: NTIS CSCL 09/2

In this paper, a single model and cost function is developed to characterize most of the file structures for a design problem that is automated. A file design system is developed that can be used by a file designer to select good file organizations from a large number of alternatives. This generalized model makes explicit the principles underlying data base construction. The computer program which implements the model uses analytic optimization techniques to select file organizations. GRA

N76-20838# Wisconsin Univ., Madison. Mathematics Research Center.

DATA MODELS FOR SECONDARY STORAGE REPRESENTATIONS

Allen Reiter Jul. 1975 64 p refs (Contract DA-31-124-ARO(D)-462)

(AD-A016347; MSR-TSR-1554) Avail: NTIS CSCL 09/2

Performance modeling of data base management systems, and in particular data base models capable of describing representation features in secondary storage, are discussed. Data structures relevant for secondary storage representations are defined, and a partial characterization of several actual systems is given. The accent is on the use of these structures in the context of a simulation model. GRA

N76-20839# Mitre Corp., Bedford, Mass.

REMOTE-TERMINAL EMULATOR (DESIGN VERIFICATION MODEL): SCENARIO ASSEMBLER

T. Suyemoto Paster Oct. 1975 89 p refs Revised 10 Vol. (Contract F19628-75-C-0001; AF Proj. 572D)

(AD-A016476; MTR-2677-Vol-4-Rev-1; ESD-TR-73-293-Rev) Avail: NTIS CSCL 09/2

The Remote-Terminal Emulator is a minicomputer-based system which generates message traffic for use in testing and evaluating large-scale, multi-terminal computer systems. This series of reports will describe the two Design Verification Models that were developed on Data General NOVA 800 minicomputers. GRA

N76-20840# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AUTOMATION OF DATA COLLECTION FOR LUBRICATED COMPONENT LIFE-CYCLE TESTING M.S. Thesis

Phillip L. Strottner Jun. 1975 83 p refs (AF Proj. 7343)

(AD-A017457; GE/EE/75-8) Avail: NTIS CSCL 09/2

A microprocessor system produced by Control Logic, Inc. and called the M Series Developmental System was configured to acquire and reduce data from an experimental test stand. The controlling program for the processor system was written in the PL/M language. The function of the system is to partially reduce data from the test stand and store the data on magnetic tape if specified requirements are met. The functions and interconnections of the system's individual modules are described in detail and the source documents for their specifications are identified. GRA

N76-20841# Aeronutronic Ford Corp., Palto Alto, Calif. Western Development Labs. Div.

RASTER GRAPHICS IMAGE TRANSFORMER Final Technical Report, 22 Jan. 1974 - 20 May 1975

Frank Brierly, John McGuigan, and Werner Sepper Jul. 1975 410 p refs (Contract F30602-74-C-0220; AF Proj. 5597)

(AD-A017483; WDL-TR-5851; RADC-TR-75-172) Avail: NTIS CSCL 09/2

This report describes the design, theory of operation, and the results of testing a component of a high performance raster graphics system (image transformer). The purpose of the image transformer is to perform various processing functions on three dimensional point and polygon data. There are two categories of processing: transformation processing and window processing. These two categories include six functions: Transformation processing - (rotation, translation, scaling, concantenation); and Window processing - (backface surface elimination, clipping). In addition design documentation for the image transformer is contained in the appendix. This includes logic diagrams and microprogram listings. GRA

N76-20842# Mitre Corp., Bedford, Mass.

JOBSTREAM SEPARATOR SYSTEM DESIGN

J. M. Schacht Sep. 1975 54 p refs (Contract F19628-75-C-0001; AF Proj. 522D)

(AD-A016403; MTR-3022-Vol-1; ESD-TR-75-86-Vol-1) Avail: NTIS CSCL 09/2

The Jobstream Separator (JSS) has been proposed to automate the costly, inefficient, and inconvenient manual process used to 'change colors' (security levels) at AF WWMCCS sites. The JSS would provide complete isolation among WWMCCS users and data at differing levels by introducing a secure, centralized, certifiably correct, minicomputer system to control electronic switching of peripheral devices during the system reconfiguration phase of the color change. The system would eliminate extensive operator intervention, reduce the delays incurred in the physical removal of storage media, and enable the operator to change security states while maintaining overall security. This report presents a technical and economic assessment of the JSS and recommends development of the prototype system. GRA

N76-20843# General Electric Co., Schenectady, N.Y.

DESIGN, FABRICATION, AND EVALUATION OF AN ELECTRON BEAM ADDRESSABLE HIGH INFORMATION DENSITY MEMORY TUBE Quarterly Report, 1 Mar. - 30 May 1975

C. Q. Lemmond, W. C. Hughes, C. G. Kirkpatrick, G. E. Possin, and J. K. Fisher Oct. 1975 37 p refs (Contract DAAB07-75-C-1312)

(AD-A016940; SRD-75-099; ECOM-1312-1-75; QR-1) Avail: NTIS CSCL 09/2

The tube is to be a sealed-off, self-contained unit consisting of an electron source, the necessary electron optics for performing the required write and read functions, and a storage structure containing approximately 1.8 x 10 to the 7th power elements. A reliable and well-engineered memory tube demonstrating life and environmental characteristics are objectives of this program. Two memory tubes are the goal of the program. Vibration tests were conducted on an electron beam memory tube furnished General Electric by the U.S. Army Electronics Command. These tests will dictate design changes necessary so that an improved tube will meet vibrational requirements. General Electric has modified its Memory Test System for tube performance tests, RFI tests and temperature tests. Several improvements to the BEAMOS tube have been made and are described. GRA

N76-20844# RAND Corp., Santa Monica, Calif.

PRIVACY AND SECURITY IN COMPUTER SYSTEMS

R. Turn and W. H. Ware Jan. 1975 27 p refs

(AD-A016493; P-5361) Avail: NTIS CSCL 09/2

This paper presents a broad overview of the three topics important in the design, operation, and use of computerized information systems and personal information databanks: safeguarding of individual rights of data subjects; providing confidentiality to identifiable personal information in statistical and research-oriented information systems; and, protecting computer resources and data files against unauthorized use by maliciously-inclined insiders or by intruders from outside. GRA

N76-20845# Texas Instruments, Inc., Dallas.

DISTRIBUTED PROCESSOR/MEMORY ARCHITECTURES DESIGN PROGRAM Final Report, 10 Dec. 1973 - 7 Dec. 1974

G. Consolver, D. Ackley, M. Rickard, R. McAfee, and T. Shipchandler Feb. 1975 498 p
(Contract F33615-74-C-1018; AF Proj. 2003)
(AD-A016482; AFAL-TR-75-80) Avail: NTIS CSCL 09/2

The purpose of Distributed Processor/Memory Architecture (DP/M) design program was to extend the DP/M avionic system processing concept to a detailed system hardware and software design. The functional design for the DP/M Processing Element (PE) is summarized, including the processor, memory, input/output interface, and a dual-level time-division-multiplex bus interface unit. A set of simulation and analysis programs was developed for modeling both the high-level network interaction among interconnected Processing Elements and the detailed internal operation of the PE. Other major areas examined were the executive control software, the process construction methodology required to develop and allocate real-time software for DP/M, and methods that could be used with DP/M to promote avionic system fault tolerance. GRA

N76-20846# Mitre Corp., Bedford, Mass.
A GENERAL SECURITY MARKING POLICY FOR CLASSIFIED COMPUTER INPUT/OUTPUT MATERIAL
J. Mogilensky Sep. 1975 64 p refs
(Contract F19628-75-C-0001; AF Proj. 522B)
(AD-A016467; MTR-3024; ESD-TR-75-89) Avail: NTIS CSCL 09/2

A security marking policy has two objectives: (1) to fulfill the basic marking requirements of the security regulations for all types of computer I/O material on a consistent, generalized basis, and (2) to ensure that the security attributes of classified data are accurately maintained on every I/O transfer. The reasons behind the need for a general policy are considered, the guidance provided by existing regulations is reviewed, and the marking policies of three existing systems are outlined. The basic concept of multilevel I/O is defined. A set of groups of I/O techniques is established, and two distinct marking policies, one for unilevel I/O and one for multilevel, are presented. Finally, an overview of the considerations involved in the implementation of trustworthy computer labeling is provided. GRA

N76-20847# Syracuse Univ., N.Y.
IDENTIFICATION OF THREE-DIMENSIONAL AIRCRAFT BY THEIR TWO-DIMENSIONAL OPTICAL IMAGES Final Technical Report, Apr. 1973 - May 1975
Ming-Kuei Hu and Kuo-Pin Wang Aug. 1975 129 p refs
(Contract F30602-73-C-0261; AF Proj. 5591)
(AD-A016434; RADC-TR-75-201-Vol-1) Avail: NTIS CSCL 09/2

To identify three-dimensional objects by their two-dimensional images (projections), the number of samples required is, in general, very large. Using two-dimensional canonical affine moments, the number of samples can be considerably reduced. This report studies the application of canonical affine moment to the three-dimensional aircraft identification problem. A simulation program based on this method is included. The primary results of using only a few samples have shown the theoretical and practical usefulness of this method. GRA

N76-20848# Michigan Univ., Ann Arbor. Systems Engineering Lab.
OPTIMAL DATA BASE SCHEMA DESIGN Interim Report, Jul. 1972 - Jun. 1975
Michael F. Mitoma Aug. 1975 354 p refs
(Contract F30602-73-C-0001; AF Proj. 5581)
(AD-A016431; RADC-TR-75-175) Avail: NTIS CSCL 09/2

This report describes a methodology that will automate and optimize the logical structure of a data base for the application that it supports. The methodology consists of three mathematical models and an automated design procedure. A case study analysis is presented and a number of optimal data bases are generated and discussed. GRA

N76-20849# RAND Corp., Santa Monica, Calif.
COMPUTERS AND STRATEGIC ADVANTAGE: 1: COMPUTER TECHNOLOGY IN THE UNITED STATES AND THE SOVIET UNION Interim Report
R. Turn and A. E. Nimitz Jul. 1975 77 p refs
(Contract F44620-73-C-0011)
(AD-A016423; R-1642-PR) Avail: NTIS CSCL 09/2

This report is one in a series of three reports that collectively examine U.S. competition with the Soviet Union in computer technology and the military advantages that the United States may achieve by virtue of superior computer technology. The present status and expected future developments in computer technology in the two countries are compared. It is concluded that although the Soviet Union lags the United States by at least five years in the capability to manufacture integrated circuits, computer systems, storage devices, and peripheral equipment, the rate of development of Soviet computer technology is high and could be further accelerated by transfer to the Soviet Union of Western technology and know-how. The relationship between computer technology and military capabilities, and the exploitation of the U.S. advantage in computer technology are further explored in R-1643-PR and R-1644-PR. GRA

N76-20850# Mitre Corp., Bedford, Mass.
REMOTE-TERMINAL EMULATOR (DESIGN VERIFICATION MODEL) DATA STRUCTURES, SCENARIO INSTRUCTIONS AND COMMANDS
D. L. James Oct. 1975 89 p refs Supersedes MTR-2677-Vol-2 Revised
(Contract F19628-75-C-0001; AF Proj. 572D)
(AD-A016404; MTR-2677-Vol-2-Rev-1; ESD-TR-74-115-Rev-1; MTR-2677-Vol-2) Avail: NTIS CSCL 09/2

The Remote-Terminal Emulator is a minicomputer-based system which generates message traffic for use in testing and evaluating large-scale multi-terminal computer systems. This series of reports describes the two Design Verification Models that were developed on Data General NOVA 800 minicomputers. This volume (revised to reflect expansions in emulator capability made since late 1973) describes the global data structures of the emulator and also defines the log tape format, scenario instruction types available, and the commands recognizable in real-time. Scenario instructions are used to construct scenarios which are the common denominator linking the real-time and non-real-time programs of the Remote-Terminal Emulator. Scenarios are programs which determine the specific actions to be taken by the emulator in real-time in emulating the behavior of terminals and operators and in controlling the run. GRA

N76-20851# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
INDEX OF AUTOMATED SYSTEM DESIGN REQUIREMENTS AS DERIVED FROM THE OMB PRIVACY ACT IMPLEMENTATION GUIDELINES Final Report
Oct. 1975 14 p
(PB-246863/5; NBSIR-75-909) Avail: NTIS HC $3.50 CSCL 09B

This index is a list of certain requirements which must be considered by Federal technical and administrative personnel in order to comply with those provisions of the Privacy Act of 1974 relating to automated systems design and development. This index has been derived from the Office of Management and Budget (OMB) guidelines for implementing those provisions. Each requirement listed contains a reference to an applicable part of the Privacy Act and to a page and column number of the OMB guidelines as they appear in the Federal Register. Therefore, these documents must be used in conjunction with this index. GRA

N76-20852# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SIMULATION AND DESIGN OF A DIGITAL DATA COMPRESSOR M.S. Thesis
John A. Pezzano Mar. 1975 96 p refs
(AD-A017186; GE/EE/75-3) Avail: NTIS CSCL 09/2

The memory required to store the output from analog to digital converters is a problem at the Air Force Weapons Laboratory because of the volume of information that needs to be saved. To reduce the memory requirements, a digital data compression technique was developed. The algorithm used, its simulation on a computer, and a hardware design based on it are discussed in this report. The algorithm is based on amplitude and slope differences from successive points from an analog to digital

converter. The computer simulation showed that memory requirements could be reduced by as much as ninety percent using this algorithm on transient signals. The hardware design enables further testing and evaluation with actual signals from field tests. GRA

N76-20853# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
PRINCIPAL COMPONENTS COLOUR DISPLAY OF ERTS IMAGERY
M. M. Taylor 1975 20 p refs Paper presented at the 2d Can. Symp. on Remote Sensing, Ontario, 29 Apr.- 1 May 1974
(AD-A017629) Avail: NTIS CSCL 09/2

The present paper describes an approach to the color display of multispectral imagery. It is not restricted to ERTS data or to four-band imagery, but can be extended to airborne multi-band sensor systems. Rather than attempting to combine pictorially the information from the different bands, the information contained in the various bands is extracted in terms of several statistically uncorrelated images. These extracted images are then used as the basis of a color display. GRA

N76-20854# Defence Research Establishment Valcartier (Quebec).
A SMALL SPECIALIZED COMPUTER FOR MEASUREMENT OF ATMOSPHERIC ATTENUATION BY LADAR
J. N. Berube Sep. 1975 78 p refs
(AD-A017645; DREV-R-4027/75) Avail: NTIS CSCL 09/2

A ladar transmissometer and rangefinder was built using TTL and ECL technology. Emphasis was placed on the electronic circuits and the performance of the rangefinder. The unit's computer calculates and displays the ranges of up to three targets when the ladar is used as a rangefinder; when used as a transmissometer it displays the atmospheric attenuation coefficient. GRA

N76-20855# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
SOME APPLICATIONS OF A METHOD OF IDENTIFYING AN ELEMENT OF A LARGE MULTIDIMENSIONAL POPULATION
Herman Chernoff 30 Oct. 1975 25 p refs
(Contract N00014-75-C-0555; NR Proj. 042-331)
(AD-A017014; TR-3) Avail: NTIS CSCL 09/2

A method is proposed for comparing a target individual with those in a large file or library of individuals on the basis of certain measured characteristics. This method is based on the likelihood-ratio test of the hypothesis that the measured characteristics of the target and a candidate from the file correspond to independently selected individuals versus the alternative that they correspond to the same individual. Only candidates for which the likelihood ratio is very large are considered. Applications of this method to the identification of fingerprints, chemical compounds and medical records are discussed. The relevance of certain information numbers is pointed out and their application to the chemical compound problem illustrated. GRA

N76-20856# Texas Univ., Austin. Electronics Research Center.
TWO-DIMENSIONAL DIGITAL FILTERING AND ITS UNCORRELATED ERROR ANALYSIS
Ming-Duenn Ni and J. K. Aggarwal 15 Jul. 1975 110 p refs
(Contract F44620-71-C-0091)
(AD-A017592; TR-175; AFOSR-75-1552TR) Avail: NTIS CSCL 09/4

The concept of a two-dimensional recursive digital filter is introduced and block diagram representations are given. Error analyses for both floating-point and fixed-point two-dimensional digital filters are carried out. A systematic way of estimating the mean squared errors due to roundoff, coefficient and input quantizations is discussed. Norm error bounds are also derived. Simulations of the implementations of digital filters are discussed, and corresponding to these simulations error calculations are performed. Numerical examples are given. The derived analytic results are shown to be in good agreement with the simulation results. GRA

N76-20857# Illinois Univ., Urbana. Computer-based Education Research Lab.
DEMONSTRATION AND EVALUATION OF THE PLATO 4 COMPUTER-BASED EDUCATION SYSTEM. (COMPUTER-BASED EDUCATION FOR A VOLUNTEER ARMED SERVICE PERSONNEL PROGRAM) Semiannual Report, 1 Jan. - 30 Jun. 1975
Sep. 1975 92 p
(Contract DAHC15-73-C-007; ARPA Order 2245)
(AD-A017399) Avail: NTIS CSCL 05/9

This report describes a program aimed at the demonstration, test and evaluation of the educational and economic effectiveness of the PLATO 4 computer-based education as implemented in several geographically dispersed military training sites. It also describes a program aimed at increasing the cost effectiveness of the PLATO system, both in its deployment in the ARPA community and in its continuing development as a national resource for education. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-20858 University of Southern Calif., Los Angeles.
SOME BASIC DETERMINANTS OF COMPUTER PROGRAMMING PERFORMANCE Ph.D. Thesis
Earl Chrysler 1975 193 p
Avail: Univ. Microfilms Order No. 76-5235

A research was undertaken to (1) determine the relationship between various computer program problem characteristics and program development time, (2) determine the relationship between various computer programmer characteristics and program development time, and (3) use the relationships found to be significant to develop a viable technique for predicting the amount of time necessary to create a computer program. The program characteristic data were analyzed and nine variables emerged from a correlation analysis as major influences on program development time. Each of these program characteristics was associated with increased program development time. The results of using correlation analysis to determine the relationship between each programmer characteristic and program development time were that all variables were significantly related to reduced program development time. These experience variables, however, also showed strong intercorrelations. Dissert. Abstr.

N76-20859 Thomson-CSF, Paris (France). D.I.B./S.C.A.S.
TEST AND SIMULATION OF LARGE SCALE INTEGRATED CIRCUITS, PART 1 Final Report [OUTIL POUR LA SIMULATION ET LE TEST DES CIRCUITS INTEGRES A GRANDE ECHELLE, 1ERE PARTIE]
E. Girard, J. C. Rault, and R. Tulloue Jul. 1974 331 p refs In FRENCH
(Contract DGRST-73-7-1392)
(SCAS-74.675) Avail: NTIS HC$10.00

Various computer programs are described to show the response to a given input sequence as applied to large scale integrated logical circuits. The circuit may be synchronous or asynchronous, and simple detectable faults such as short circuits, open circuits, and stuck gates are listed. The programs have different accuracy requirements as dictated by the simulation needs. A predictive algorithm is used based on construction and exploitation of event scheduling. The circuits are described at gate or macroset level. Their description and the event scheduling description are memorized by the computer in list format. A detailed bibliography containing 1,180 items is given. ESA

N76-20860*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
THE USE OF GENERAL PURPOSE COMPUTER PROGRAMS TO DERIVE EQUATIONS OF MOTION FOR OPTIMAL ISOLATION STUDIES Final Report
Walter D. Pilkey and Y. H. Chen Sep. 1975 31 p refs
(Grant NGR-47-005-145)
(NASA-CR-146659; ESS-4085-112-75) Avail: NTIS

HC $4.00 CSCL 09B

Techniques whereby a general purpose structural analysis program may be used to form the equations required for available limiting performance capabilities are reported. The techniques permit a limiting performance study on arbitary structural or mechanical systems which normally would involve finite element modeling for an analysis. Numerical examples were carried out to verify the formulations by the SAP 4 general purpose computer program. Author

N76-20861*# Houston Univ., Tex. Dept. of Mathematics.
UHMLE: PROGRAM DESCRIPTION USER GUIDE
W. A. Cobely and C. L. Wiginton Oct. 1975 21 p refs
(Contract NAS9-12777)
(NASA-CR-147520; Rept-48) Avail: NTIS HC $3.50 CSCL 09B

A program which computes maximum likelihood estimates for the general normal mixture is introduced. The program allows the user to fix any subsets of the mixture parameters; this fixed set may be redefined at various times in the iteration process. There is considerable time saved in computing the likelihoods if the diagonal form is specified. Hence, in the early iterations the diagonal assumption might be used, changing over to the full covariance mode later in the iteration process for a more refined solution. This flexibility allows the user to choose the sequence of parameter configurations in the iteration process which he feels will optimize the computation time required as well as possibly avoid convergence to suboptimal local maxima of the likelihood function. Author

N76-20862*# Oakland Univ., Rochester, Mich. School of Engineering.
INVESTIGATION OF CORRELATION CLASSIFICATION TECHNIQUES Final Report
Richard E. Haskell Dec. 1975 114 p refs
(Contract NAS9-14195)
(NASA-CR-147524) Avail: NTIS HC $5.50 CSCL 09B

A two-step classification algorithm for processing multispectral scanner data was developed and tested. The first step is a single pass clustering algorithm that assigns each pixel, based on its spectral signature, to a particular cluster. The output of that step is a cluster tape in which a single integer is associated with each pixel. The cluster tape is used as the input to the second step, where ground truth information is used to classify each cluster using an iterative method of potentials. Once the clusters have been assigned to classes the cluster tape is read pixel-by-pixel and an output tape is produced in which each pixel is assigned to its proper class. In addition to the digital classification programs, a method of using correlation clustering to process multispectral scanner data in real time by means of an interactive color video display is also described. Author

N76-20863*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NONDETERMINISTIC DATA BASE FOR COMPUTERIZED VISUAL PERCEPTION
Y. Yakimovsky 1 Feb. 1976 23 p refs
(Contract NAS7-100)
(NASA-CR-146578; JPL-TM-33-761) Avail: NTIS HC $3.50 CSCL 09B

A description is given of the knowledge representation data base in the perception subsystem of the Mars robot vehicle prototype. Two types of information are stored. The first is generic information that represents general rules that are conformed to by structures in the expected environments. The second kind of information is a specific description of a structure, i.e., the properties and relations of objects in the specific case being analyzed. The generic knowledge is represented so that it can be applied to extract and infer the description of specific structures. The generic model of the rules is substantially a Bayesian representation of the statistics of the environment, which means it is geared to representation of nondeterministic rules relating properties of, and relations between, objects. The description of a specific structure is also nondeterministic in the sense that all properties and relations may take a range of values with an associated probability distribution. Author

N76-20864# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
THE PRINCIPLES OF CUTTING-PLANE THEORY. PART 2: ALGEBRAIC METHODS, DISJUNCTIVE METHODS Management Sciences Research Report
Robert G. Jeroslow Aug. 1975 119 p refs
(Contract N00014-67-A-0314-0007; Grant NSF GP-37510; NR Proj. 047-048)
(AD-A015908; RR-370-Pt-2) Avail: NTIS CSCL 12/2

In this paper the author, surveys the algebraic and disjunctive methods, and includes several new results, such as finiteness proofs for new classes of cuttingplane algorithms, a subadditive algorithm for integer programs, and sharpened results on subadditive dual programs, plus other theorems. The author has tried to bring together many of the most quoted results in the theory of integer programming, to provide the most concise proofs for these of which he is aware, and to show the interrelations between these results. GRA

N76-20865# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
AN EMPIRICAL STOPPING RULE FOR DEBUGGING AND TESTING COMPUTER SOFTWARE
Ernest H. Forman and Nozer D. Singpurwalla 18 Aug. 1975 27 p refs
(Contracts N00014-75-C-0729; F33615-75-C-4040; NR Proj. 347-020)
(AD-A016027; Serial-T-320) Avail: NTIS CSCL 09/2

In this paper the authors introduce the problem of computer software reliability and discuss a probabilistic model for describing the failure of software. The authors suggest a procedure for estimating the parameters of the model, and propose a stopping rule for debugging the software. The authors also obtain an expression for additional testing of the software by considering the cost of testing, the cost of the failure of the software during its intended operation, and the power of the testing procedure. GRA

N76-20866# Naval Ship Research and Development Center, Bethesda, Md.
THE EIGENSYSTEM CAPABILITY OF FOUR SUBROUTINE LIBRARIES AVAILABLE AT DTNSRDC
Donald A. Gignac Jul. 1975 28 p refs
(SR0140301)
(AD-A015949; NSRDC-4710) Avail: NTIS CSCL 12/1

The need to compute eigenvalues and eigenvectors arises frequently in applied work in the Navy's varied research program. For a given eigensystem problem several algorithms (methods) may be considered and for a given algorithm several FORTRAN subroutine implementations may be available to choose from. This report offers help in choosing among the options available at DTNSRDC for the solution of eigensystem problems. GRA

N76-20867# Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
DOT MATRIX DISPLAY SYMBOLOGY STUDY Final Report, 29 Jan. - 21 Nov. 1974
R. J. VanderKolk, J. A. Herman, and M. L. Hershberger Jul. 1975 201 p refs
(Contract F33615-74-C-3065; AF Proj. 2020)
(AD-A016470; HAC-P75-114K; HAC-Ref-D1165; AFFDL-TR-75-72) Avail: NTIS CSCL 09/3

This report describes a concentrated effort to identify and quantify the parameters involved in the design of matrix displays for legibility and to assess the design trade-offs against the criterion of symbol legibility. A literature survey was conducted to determine what information previously existed and its applicability to matrix displays. The literature survey is included as an appendix to this report. GRA

N76-20868# Mitre Corp., Bedford, Mass.
AN AIR FORCE GUIDE FOR MONITORING AND REPORTING SOFTWARE DEVELOPMENT STATUS
S. R. Hagan and C. W. Knight Sep. 1975 99 p refs
(Contract F19628-75-C-0001; AF Proj. 572H)
(AD-A016488; MTR-3051; ESD-TR-75-85) Avail: NTIS CSCL 09/2

This guidebook is one in a series covering important aspects of software acquisition management. It is intended for managers and technical personnel engaged in, or planning for, the monitoring

and reporting of the technical status of a software development project. The guidebook explains the principal status monitoring tools such as milestone management, status meetings, reports, and interviews. Status estimating techniques are discussed, as is contractual planning for ensuring government visibility. GRA

N76-20869# Mitre Corp., Bedford, Mass.
SOFTWARE ACQUISITION MANAGEMENT GUIDEBOOK: REGULATIONS, SPECIFICATIONS AND STANDARDS
J. T. Connolly Oct. 1975 124 p refs
(Contract F19628-75-C-0001; AF Proj. 572H)
(AD-A016401; MTR-3080; ESD-TR-75-91) Avail: NTIS CSCL 09/2

Regulations, specifications and standards pertinent to Air Force software acquisition are identified and categorized by management and software development tasks required during a system acquisition. The place of software development in a system life cycle and the two principal Air Force management regulations impacting on software acquisition are discussed. Brief summaries of regulations, specifications and standards, and keyword cross-reference lists are included for selected documents. GRA

N76-20870# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A COMPUTER SOLUTION OF THE BUCKINGHAM Pi THEOREM USING SYMBOLANG, A SYMBOLIC MANIPULATION LANGUAGE Final Report
Morton A. Hirschberg Aug. 1975 20 p refs
(AD-A016901; BRL-1824) Avail: NTIS CSCL 09/2

Among the theories of similitude, application of the Buckingham Pi Theorem allows one to find meaningful relationships among variables, check the formulation of a system of equations, and allow prediction from scaled parameters. Simply stated, the Pi Theorem asserts that if there are n variables involving N fundamental units, these may be combined to form n-N dimensionless parameters each containing N-1 variables. SYMBOLANG is a FORTRAN-based symbol manipulator using a list structure. Symbol manipulators operate on strings of symbols rather than numbers. As an example, a symbol manipulator allows multiplication of N-1 by N-1 to obtain (N sup 2)-1. A list structure allows data to be stored and manipulated by relationships rather than sequentially or by some other scheme. GRA

N76-20871# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FUNCTION GENERATION FOR ANALOG SIMULATION STUDIES
Ralph E. Shear Sep. 1975 17 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A016898; BRL-1828) Avail: NTIS CSCL 09/2

Dynamic programming algorithms and computer programs have been developed for automatic generation of functions for analog simulation studies. The algorithms provide a fit consisting of continuous piecewise linear functions which minimizes a given functional subject to non-negativity and integral constraints. The algorithms developed are efficient in terms of cost and time and provide an accurate, effective and useful means of function generation. GRA

N76-20872# Wisconsin Univ., Madison. Inst. for Environmental Studies.
WISSIM, A SIMULATION COMMAND LANGUAGE. PART 2: USERS GUIDE FOR INTERFACING WISSIM AND SIMULATION MODELS Energy Systems and Policy Research Group. No. 13
J. S. Buehring and P. D. Kishline Dec. 1974 25 p refs
(Grant NSF GI-43088)
(PB-245969/1; IES-40-Pt-2; NSF/RA/N-74-220-Pt-2) Avail: NTIS HC $3.50 CSCL 09B

WISSIM (Wisconsin Simulation) is a computer simulation control language designed to provide a convenient interface between computer simulation models and their users and to facilitate the writing of such models. WISSIM is linked with a user-written FORTRAN program that contains the code for the actual simulation. The control language has commands to modify and display parameters, print reports, save data, and graph data. The information necessary to interface a FORTRAN simulation program with WISSIM is included. GRA

N76-20873# Wisconsin Univ., Madison. Inst. for Environmental Studies.
WISSIM, A SIMULATION COMMAND LANGUAGE. PART 1: USERS GUIDE TO WISSIM COMMANDS Energy Systems and Policy Research Group No. 9
P. D. Kishline and J. S. Buehring Dec. 1974 50 p refs
(Grant NSF GI-43088)
(PB-245968/3; IES-39-Pt-1; NSF/RA/N-74-216-Pt-1) Avail: NTIS HC $4.00 CSCL 09B

A detailed users guide is presented for WISSIM (WISconsin SIMulation), a simulation control language. The design of the command language is such that the user need only know enough FORTRAN to write the rules of change from one time period to the next of the system being simulated. WISSIM provides the user time incrementation, graphing, changing values, output of requested values, and the saving of values of examination at a later time. The purpose, format and several examples are provided in this report for each command. GRA

N76-20874# Computer Linguistics, Inc., Albany, N.Y.
A SURVEY OF OPTIMIZATION TECHNIQUES IN COMPILERS Final Technical Report, 23 Apr. 1974 - 23 Feb. 1975
Steven S. Herrick and David V. Donnelly Griffiss AFB, N. Y. RADC Sep. 1975 255 p refs
(Contract F30602-74-C-0188; AF Proj. 5550)
(AD-A017404; RADC-TR-75-223) Avail: NTIS CSCL 09/2

A compendium of compilation processes and compiler organization relating to program optimization is presented, where evaluations of underlying cost/benefit relationships is the focus for this study. To obtain this goal a compiler model to relate the optimization algorithms to the compilation process is introduced. From this a discussion of general optimization philosophy leading to descriptions, analyses, and reviews of the most significant optimization algorithms is made; the benefits of these algorithms are considered, and recommendations for future measurements are proposed. GRA

N76-20875# Illinois Univ., Urbana. Coordinated Science Lab.
HARDWARE AND SOFTWARE ERROR CORRECTION CODING Final Technical Report, Sep. 1971 - Sep. 1974
R. T. Chien, R. B. Brown, C. L. Chen, and D. V. Sarwate Aug. 1975 160 p refs
(Contract F30602-72-C-0031; AF Proj. 4519)
(AD-A017377; RADC-TR-75-217) Avail: NTIS CSCL 09/4

This report describes the results of a two phase project. In the first phase, a hardware coding system, which uses two newly developed decoding concepts, was designed and constructed. In the second phase, a software coding system was implemented. Several tradeoffs among alternative software implementations are given. The choice between hardware and software approaches is also considered. GRA

N76-20876# Naval Postgraduate School, Monterey, Calif.
MULTITYPE MULTIPROGRAMMING: PROBABILITY MODELS AND NUMERICAL PROCEDURES
Donald P. Gaver and George Humfeld Oct. 1975 23 p refs
(AD-A017607; NPS-54Gv75101) Avail: NTIS CSCL 09/2

This report describes mathematical models for use in evaluating the performance of complex computer systems. Numerical methods are given to compute operating characteristics of systems when two types of jobs are present. GRA

N76-20877# Stanford Univ., Calif. Dept. of Computer Science.
TOWARDS A SEMANTIC THEORY OF DYNAMIC BINDING
Michael Gordon Aug. 1975 30 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A017175; SU-STAN-CS-75-507; AIM-265) Avail: NTIS CSCL 09/2

The results in this paper contribute to the formulation of a semantic theory of dynamic binding (fluid variables). The axioms and theorems are language independent in that they don't talk about programs i.e. syntactic objects - but just about elements in certain domains. Firstly the equivalence (in the circumstances where it's true) of 'tying a knot' through the environment (elaborated in the paper) and taking a least fixed point is shown. This is central in proving the correctness of LISP eval type

interpreters. Secondly the relation which must hold between two environments if a program is to have the same meaning in both is established. It is shown how the theory can be applied to LISP to yield previously known facts. Author (GRA)

N76-20878# Navy Personnel Research and Development Center, San Diego, Calif.
AN AIDE TO INDEPENDENT STUDY THROUGH AUTOMATIC QUESTION GENERATION (AUTOQUEST) Technical Report, 1 Jul. 1973 - 30 Jun. 1975
John H. Wolfe Oct. 1975 37 p refs Sponsored in part by ARPA
(PF55522002)
(AD-A017059; NPRDC-TR-76-18) Avail: NTIS CSCL 05/9

AUTOQUEST is a computer aid to independent study. It presents ordinary text to a student at a computer terminal, a paragraph at a time. Using a pattern-matching approach, the system generates a question based on one of the sentences of the text and grades the student's answer. If the student's answer does not match the words of the text, the paragraph is displayed again. Results showed that about 68% of the generated questions were satisfactory and the errors were largely syntactic, indicating the need for a structural parser to preprocess the sentences. The economic feasibility of AUTOQUEST is discussed and judged to be good within 5 years. GRA

N76-20879# System Development Corp., Santa Monica, Calif.
APPLICATION OF TACTICAL DATA SYSTEMS FOR TRAINING: DEVTOS FEASIBILITY DETERMINATION AND SELECTION OF AN INSTRUCTIONAL OPERATING SYSTEM Interim Report, Dec. 1972 - Dec. 1973
Oct. 1975 62 p refs
(Contract DAHC-2-Q-062106-A-721)
(AD-A017436; ARI-Tech-Paper-267) Avail: NTIS CSCL 05/9

The U.S. Army is likely to have a considerable data processing capability at the tactical unit level soon. A potential secondary role for these tactical data systems, when they are not required for tactical operations, is that of supporting unit and individual training. This report is the first of a series on the use of tactical data systems for training. GRA

N76-20880# Stanford Univ., Calif. Dept. of Computer Sciences.
TOWARDS BETTER STRUCTURED DEFINITIONS OF PROGRAMMING LANGUAGES
Reino Kurki-Suonio Sep. 1975 32 p refs
(Grant NSF DCR-72-03752-A02)
(PB-246708/2; SU-STAN-CS-75-500) Avail: NTIS HC $4.00 CSCL 09B

The use of abstract syntax and a behavioral model is discussed from the viewpoint of structuring the complexity in definitions of programming languages. A formalism for abstract syntax is presented which reflects the possibility of having one defining occurrence and an arbitrary number of applied occurrences of objects. Attributes can be associated with such a syntax for restricting the set of objects generated, and for defining character string representations and semantic interpretations for the objects. A system of co-operating automata, described by another abstract syntax, is proposed as a behavioral model for semantic definition. GRA

N76-20881# National Institutes of Health, Bethesda, Md. Div. of Computer Research and Technology.
PROJ. RMAG. ARITHMETIC SUBROUTINE, USER'S GUIDE
Robert A. Magnuson Nov. 1975 50 p refs
(PB-246644/9; NIH-DCRT-DMS-SSS-AN504A; NIH/DF-75/004a) Avail: NTIS HC $4.00 CSCL 09B

Availability of a comprehensive, powerful, new subroutine used to dynamically evaluate arithmetic expressions is announced. This subroutine, written using a modern structured programming compiler, is available to the higher order language IBM 370 programmer enabling him to instantly enhance his system by adding sophisticated arithmetic specification to his user communications. It is capable of analyzing and evaluating expressions containing some 49 powerful operators using 19 hierarchy levels, parentheses nested to any level, and including conditional subexpressions and deeply embedded replacement operators. GRA

N76-20882*# Illinois Univ., Urbana. Dept. of Computer Science.
A CLASS OF COMPACT HIGH SPEED PARALLEL MULTIPLICATION SCHEMES M.S. Thesis
William John Stenzel Sep. 1975 79 p refs
(Contract NAS5-23334)
(NASA-CR-146714; PB-246941/9; UIUCDCS-R-75-756) Avail: NTIS HC $5.00 CSCL 09B

Parallel multiplication schemes are divisible into 2 classes iterative cellular array schemes and Dadda-type schemes in which a partial product matrix is generated and then reduced by means of pseudo adders. Current LSI technology has made possible ICs which can form smaller partial product matrices as well as ICs which can reduce larger portions of matrices than traditional pseudo adders. Such compact form of generation-reduction multipliers are considered. An algorithm for their design is presented and a prototype 24 x 24 bit multiplier is presented. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N76-20883# Royal Radar Establishment, Malvern (England).
CHANGING PRINCIPLES OF COMPLEX SYSTEMS DEVELOPMENT
C. S. E. Phillips May 1975 17 p refs Presented at the Symp. on Management Problems in the Design and Develop. of Complex Defence Computer-based Inform. and Weapon Systems, Shrivenham, Engl., 17-18 Apr. 1975
(RRE-TN-790; BR48677) Avail: NTIS HC $3.50

Management problems in developing computer based systems are outlined. Difficulties are mainly attributed to the nature of man-made systems and, partly, to the nature of computer programming. The reasons are discussed at some length and possible solutions are explored. ESA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support*.

N76-20884*# Houston Univ., Tex. Dept. of Mathematics.
APPLICATIONS OF MATRIX DERIVATIVES TO OPTIMIZATION PROBLEMS IN STATISTICAL PATTERN RECOGNITION
Joseph S. Morrell Aug. 1975 27 p refs
(Contract NAS9-12777)
(NASA-CR-147523; Rept-45) Avail: NTIS HC $4.00 CSCL 09B

A necessary condition for a real valued Frechet differentiable function of a vector variable have an extremum at a vector x sub 0 is that the Frechet derivative vanishes at x sub 0. A relationship between Frechet differentials and matrix derivatives was established that obtains a necessary condition on the matrix derivative at an extrema. These results are applied to various scalar functions of matrix variables which occur in statistical pattern recognition. Author

N76-20885# Yale Univ., New Haven, Conn. Dept. of Computer Science.
SAM: A STORY UNDERSTANDER
Roger C. Schank Aug. 1975 47 p refs
(Contract N00014-75-C-1111)
(AD-A015689; RR-43) Avail: NTIS CSCL 09/2

A program is described that understands stories. The program can answer questions about stories it has read as well as paraphrase them, translate them into Chinese, and summarize them. GRA

N76-20886# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
PERIODIC CONTROL OF VEHICLE CRUISE: IMPROVED FUEL ECONOMY BY HIGH AND LOW FREQUENCY SWITCHING Interim Report
Elmer G. Gilbert Apr. 1975 11 p refs
(Grant AF-AFOSR-2517-73; AF Proj. 9769)
(AD-A015927; AFOSR-75-1337TR) Avail: NTIS CSCL 12/1

It is shown that time-dependent periodic control can improve the fuel economy of vehicles in cruise. The time-dependent controls considered are relaxed steady-state (RSS) control, quasi-steady-state (QSS) control, and quasi-relaxed steady-state (QRSS) control. Examples are given which show that QRSS control may give better performance than either RSS or QSS control. Properties of optimal cost functions (dependent on the minimum required average speed) are derived. The possibility or impossibility of improved performance through the use of QRSS, QSS, and RSS control is investigated in terms of assumptions on the vehicle drag and fuel-consumption functions. GRA

N76-20887# Stanford Univ., Calif. Computer Science Dept.
OPERATIONAL REASONING AND DENOTATIONAL SEMANTICS
Michael Gordon Aug. 1975 35 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A017176; SU-STAN-CS-75-506; AIM-264) Avail: NTIS CSCL 09/2

Obviously true properties of programs can be hard to prove when meanings are specified with a denotational semantics. One cause of this is that such a semantics usually abstracts away from the running process - thus properties which are obvious when one thinks about this lose the basis of their obviousness in the absence of it. To enable process-based intuitions to be used in constructing proofs one can associate with the semantics an abstract interpreter so that reasoning about the semantics can be done by reasoning about computations on the interpreter. This technique is used to prove several facts about a semantics of pure LISP. First a denotational semantics and an abstract interpreter are described. Then it is shown that the denotation of any LISP form is correctly computed by the interpreter. This is used to justify an inference rule - called LISP-induction - which formalises induction on the size of computations on the interpreter. Finally LISP-induction is used to prove a number of results. In particular it is shown that the function eval is correct relative to the semantics i.e. that it denotes a mapping which maps forms (coded as S-expressions) on to their correct values.
Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-20888 Illinois Univ., Urbana.
APPROXIMATION OF INFINITE DYNAMIC GAS MODELS Ph.D. Thesis
James Edward Frykman 1975 117 p
Avail: Univ. Microfilms Order No. 76-6763

Let I be a countably infinite space, let (0,1) have the discrete topology, and let X = (0,1)I have the product topology. Let c(i,x) on I x I and p(i,j,x) on I x I x X be non-negative real valued functions. Defining an operator, Omega, on a dense set of C(X), it is shown that the operator is the infinitesimal generator of a strongly continuous Markov semigroup Pt on C(X) under suitable conditions on c and p. The Pt semigroup describes the time evolution of a system of particles subject to speed change and exclusion of multiple occupancy of sites in I. Using conditions stronger than those imposed by Liggett such a semigroup is approximated by interacting particle systems on finite subsets of I. It is shown that a probability measure is Pt invariant if and only if it is the vague limit of a sequence of probability measures each of which is invariant for a finite particle system approximation. The results are applied to the model in which c(i, x) is given by a symmetric pair potential and p(i,j,x) is independent of x, symmetric, and irreducible. Dissert. Abstr.

N76-20889 Stevens Inst. of Tech., Hoboken, N.J.
A DIMINISHING ERROR APPROACH TO MULTIVARIABLE EXPANSIONS OF SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS Ph.D. Thesis
Wilson Chukwunwike Obi 1975 234 p
Avail: Univ. Microfilms Order No. 76-5033

The concepts of the DEA method are first considered in a very general setting from which modified workable forms may be recovered. The technique is applied to a problem using linear time scales and is shown to lead to generalized uniform asymptotic expansions which may be completely determined in a single analysis by deriving formulas giving the higher order approximations. Then a method for generating time scales from differential equations without recourse to intuitive arguments is described. This combination is referred to as the regular diminishing error approach (RDEA). It is shown in general that a region of uniform validity of the RDEA expansions exists, and applications to specific examples illustrate that this region could be infinite. Specific examples are also used to demonstrate how an examination of the residual error terms can lead to an estimate of the region of dependable accuracy of those expansions. The use of numerical calculations to supplement analytical results is emphasized. Dissert. Abstr.

N76-20890 Washington Univ., Seattle.
ON LEVEL CURVES OF GREEN'S FUNCTIONS AND GREEN'S LINES ON GENERAL PLANE DOMAINS Ph.D. Thesis
Margot Maria Simons Pallmann 1975 111 p
Avail: Univ. Microfilms Order No. 76-4773

A domain D on the Z-sphere with boundary delta D of positive logarithmic capacity has a green function g(z,z sub 0) with pole at z sub 0, z sub 0 epsilon D. If the boundary of D is any closed bounded set, g(z,z sub 0) may not always have the limit 0 as z tends to delta D. Disregarding the removable boundary points it can merely be asserted that at the remaining boundary points the inferior limit of g(z,z sub) is 0. If at any such point the superior limit of g(z,z sub 0) is positive, then we are dealing with an irregular boundary point. The structure of the families of level curves and green lines of g(z,z sub 0) is investigated and the possible existence of irregular boundary points is admitted. A first result relates to the family of level curves. A linear measure v is defined on the set of all level curves of g(z,z sub 0), considering these level curves as points of the set.
Author

N76-20891 Stevens Inst. of Tech., Hoboken, N.J.
THE RELATIVISTIC BURNETT EQUATIONS Ph.D. Thesis
Arthur Capen Payne, Jr. 1975 68 p
Avail: Univ. Microfilms Order No. 76-5034

Using the relaxation-time model proposed by Anderson and Witting for the collision term of the relativistic Boltzmann equation of a single component gas, the resulting equation was solved using the relativistic Chapman-Enskog method proposed by Marle for the second order transport coefficients (i.e., the Burnett equations). Using the Burnett equations the velocity of sound was calculated and the resulting dispersion is explicitly shown.
Dissert. Abstr.

N76-20892 Northeastern Univ., Boston, Mass.
ON FINDING THE STRICT APPROXIMATION FOR REAL ANALYTIC FUNCTIONS Ph.D. Thesis
Shimshon Berkovits 1973 74 p
Avail: Univ. Microfilms Order No. 75-28885

Let E be a finite-dimensional linear space of real-valued functions defined on a compact set X. Let F be a real-valued function on X which is not in E. It is known that the best approximation to F by elements of E in the L(P) norm is unique for each finite $p > 1$. Furthermore, as p approaches infinity, the set of best L(P) approximations contains convergent subsequences and all such subsequences have their limit points in the set of best Chebyshev approximations. A constructive algorithm is presented for finding the strict approximation when all functions involved are real analytic on the unit interval. This is done by first developing an asymptotic expansion for the pth power of the pth norm of the error function in terms of the coefficients of its series expansion about critical points-i.e., about those points at which the error function achieves its maximum absolute value.

The coefficients of increasing powers of 1/p in this expansion are then minimized over the set of best Chebyshev approximations. Dissert. Abstr.

N76-20893 Michigan State Univ., East Lansing.
STABILITY AND INVARIANCE OF FUNCTIONAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Reng-Song Lo 1975 73 p
Avail: Univ. Microfilms Order No. 76-5598

In recent years, Liapunov's method has been successively generalized to functional differential equations of retarded type by using Liapunov functionals. However, in many cases the problems are still open. A complete characterization of integral stability has been obtained for ordinary differential equations by a Lipschitz/Liapunov function which obeys certain bounds. But the problem in functional differential equations is still open. Another fundamental problem in differential equations is the characterization of invariance sets. The above two open problems were investigated. First in the case of integral stability, it is shown that the usual approach of Liapunov's method is not very useful. In the case of an invariance set, the hereditary nature of the equation prevents a straightforward generalization to functional differential equations. For this purpose, a new Liapunov's theorem based on a class of lower semi-continuous non-Lipschitz functionals was developed. Complete characterization of integral stability and sets of invariance was obtained using the Liapunov theory. Dissert. Abstr.

N76-20894# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany). Inst. fuer Mathematik.
[MATHEMATICAL PHYSICS METHODS]
1975 39 p refs In GERMAN
(GMD-Mitt-33) Avail: NTIS HC $4.00

The Dirichlet exterior space problem of the plate equation was treated using numerical integration and series interruption. The Dirichlet boundary value problem was solved using an approximation technique involving suitable linear combinations of special solutions of the differential equation. It is shown that this technique can be applied to the Neumann boundary value problem of the Helmholtz oscillation equation. For individual titles, see N76-20895 through N76-20897.

N76-20895 Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
NUMERICAL TREATMENT OF THE DIRICHLET EXTERIOR SPACE PROBLEM OF THE PLATE EQUATION [ZUR NUMERISCHEN BEHANDLUNG DER DIRICHLETSCHEN AUSSENRAUMAUFGABE DER PLATTENGLEICHUNG]
Manfred Achilles *In its* Math. Phys. Methods 1975 p 1-16 refs In GERMAN (For availability see N76-20894 11-64)

The solution of the plate equation in the exterior space is presented and the errors resulting from the numerical integration and from series interruption were estimated. ESA

N76-20896 Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
APPROXIMATION OF THE SOLUTION OF DIRICHLET BOUNDARY VALUE PROBLEMS [UEBER DIE APPROXIMATION DER LOESUNG DIRICHLETSCHER RANDWERTPROBLEME]
Eckhard Reinartz *In its* Math. Phys. Methods 1975 p 17-30 refs In GERMAN (For availability see N76-20894 11-64)

The approximation of the exact solution of the elliptic boundary value equation through a suitable linear combination of special solutions of the differential equation, using the Bergman and Vekua theories, is discussed. The application of estimating the best approximation of problems published elsewhere by the author is presented. ESA

N76-20897 Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
REMARKS ON THE PROCEDURE FOR SOLVING THE NEUMANN BOUNDARY VALUE PROBLEM OF THE HELMHOLTZ OSCILLATION EQUATION [BEMERKUNGEN ZU EINEM LOESUNGSVERFAHREN FUER DAS NEUMANNSCHE RANDWERTPROBLEM DER HELMHOLTZSCHEN SCHWINGUNGSGLEICHUNG]
Eckhard Reinartz *In its* Math. Phys. Methods 1975 p 31-36 refs In GERMAN (For availability see N76-20894 11-64)

The applicability of an approximation technique for solving Dirichlet boundary value problems, to the Neumann boundary value problem, if limited to certain differential equations and to certain spaces, is shown. As an example the Neumann exterior space problem for the normalized Helmholtz oscillation equation delta u + u = 0 was used. ESA

N76-20898# Gesellschaft fuer Mathematik und Datenverarbeitung, Bonn (West Germany).
A CONSTRUCTIVE METHOD FOR THE SOLUTION OF ELLIPTIC BOUNDARY VALUE PROBLEMS [EINE KONSTRUKTIVE METHODE ZUR LOESUNG ELLIPTISCHER RANDWERTPROBLEME]
Eckhard Reinartz 1974 85 p refs In GERMAN Sponsored in part by Bundesmin. fuer Forsch. u. Technol. and Landesamt fuer Forsch. of Nordrhein-Westfalen
(BMFT-GMD-94) Avail: NTIS HC $5.00; Ges. fuer Math. und Datenverarbeitung DM 9

The solution of the elliptic boundary value problem was approximated using suitable linear combinations of partial differential equations. Some results of Vekna and Bergmann were combined to solve the general elliptic case Lu = 0 with real analytical coefficients. The Dirichlet boundary value problem of the equation delta u + cu = 0 was investigated. Similarly the internal and external Dirichlet problem of delta u + kzu = 0 were treated. Generalizations of the above methods were made and numerical examples, calculated on an IBM/370-165, are discussed. ESA

N76-20899# Naval Research Lab., Washington, D.C.
TABLES OF ANGULAR SPHEROIDAL WAVE FUNCTIONS. VOLUME 1: PROLATE, m EQUALS 0
Arnie Lee VanBuren, Benson J. King, Roland V. Baier, and Sam Hanish 30 Jun. 1975 436 p refs
(AD-A016669; LC-75-15170-Vol-1) Avail: NTIS MF $2.25; HC Avail SOD CSCL 12/1

Contents: Oblate spheroidal coordinates; Factored solutions of the Helmholtz wave equation in oblate spheroidal coordinates; Oblate angular functions; Computational procedure; Accuracy of the tables; Use of the tables--expansion of g, evaluation of the coefficients (d sub n), calculation of the integrals (I sub l); Historical review; References and bibliography; Symbols used in the tables; Range of variables. GRA

N76-20900# Naval Research Lab., Washington, D.C.
TABLES OF ANGULAR SPHEROIDAL WAVE FUNCTIONS. VOLUME 2: OBLATE, m EQUALS 0
Arnie Lee VanBuren, Benson J. King, Roland V. Baier, and Sam Hanish 30 Jun. 1975 428 p refs
(AD-A016670; LC-75-15171-Vol-2) Avail: NTIS MF $2.25; HC Avail SOD CSCL 12/1

For abstract, see N76-20899.

N76-20901# Yale Univ., New Haven, Conn.
ON THE STABILITY OF NON-AUTONOMOUS DIFFERENTIAL EQUATIONS dx/dt = [A + B(t)]x WITH SKEW-SYMMETRIC MATRIX B(m)
A. P. Morgan and K. S. Narendra Aug. 1975 24 p refs
(Contract N00014-67-A-0097-0020)
(AD-A015703; CT-66) Avail: NTIS CSCL 12/1

The uniform asymptotic stability of equations is characterized where A + A(T) is stable in the richness of B(t). Equations, arising in connection with questions of adaptive identification and control, are described. J.A.M.

N76-20902# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
OPTIMAL USE OF INFORMATION IN CERTAIN ITERATIVE PROCESSES
Robert Meersman Jul. 1975 20 p refs
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A016228) Avail: NTIS CSCL 12/1

The k-point stationary iterative processes are investigated to numerically approximate a zero alpha for a real analytic function. Author

N76-20903# Stanford Univ., Calif. Dept. of Operations Research.
POINT PROCESSES ATTACHED TO A MARKOV PROCESS BY A MARKOV ADDITIVE PROCESS
P. A. Jacobs Dec. 1974 26 p refs
(Contract N00014-67-A-0112-0011; NR Proj. 047-064)
(AD-A016238; TR-74-24) Avail: NTIS CSCL 12/1

Let L be a continuous additive functional with support C of a Hunt process X = (X sub t; t equal to or greater than 0). Let S be the inverse of L. Put Y sub t = X sub S sub t. Then((Y sub t, S sub t); t equal to or greater than) is a Markov additive process. For each time of discontinuity u of S, let Z(t) be the corresponding excursion of X outside of C. The conditional structure of (z(t)) given 1(y sub t; t equal to or greater than 0) is studied. Author

N76-20904# Stanford Univ., Calif. Dept. of Statistics.
ASYMPTOTIC PROPERTIES OF SOME ESTIMATORS IN MOVING AVERAGE MODEL
Paul Pedro Mentz 8 Sep. 1975 158 p refs
(Contract N00014-75-C-0442; NR Proj. 042-034)
(AD-A016232; TR-21) Avail: NTIS CSCL 12/1

Estimation procedures are considered for the moving average model of order q. Walker's method uses k sample autocovariances (k greater than or equal to q). We let k depend on T in such a way that K approaches infinity as T approaches infinity. The estimates are consistent, asymptotically normal and asyptotically efficient if K k(T) dominates log T and is dominated by T 1/2. The approach in proving these theorems involves obtaining an explicit form for the components of the inverse of a symmetric matrix with equal elements along its five central diagonals, and zeroes elsewhere. The asymptotic normality follows from a central limit theorem for normalized sums of random variables that are dependent of order k, where k tends to infinity with T. GRA

N76-20905# Stanford Univ., Calif. Dept. of Operations Research.
ON THE RISK-SENSITIVE OPTIMALITY CRITERIA FOR MARKOV DECISION PROCESSES
Karel Sladky 15 May 1975 25 p refs
(Contract N00014-75-C-0493; Grant NSF ENG-74-12378; NR Proj. 042-264)
(AD-A016234; TR-30) Avail: NTIS CSCL 12/1

Discrete dynamic programming models with an exponential utility function are studied with respect to the asymptotic behavior of the dynamic programming recursion for the expected utility. Preliminary results on maximizing the asymptotic growth of the expected utility in the class of stationary policies are presented. Under the condition that there exists a stationary 'optimal' policy with an irreducible, aperiodic transition probability matrix, some nice limiting properties for the maximum expected utilities are established. Moreover, it is shown how to generate a monotonic sequence of lower and upper bounds on the maximum growth rate of the expected utility. Under certain additional assumptions it is possible to extend the obtained results to Markov decision processes with a denumerable state space. GRA

N76-20906# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
INVARIANTS AND CANONICAL FORMS UNDER DYNAMIC COMPENSATION
W. A. Wolovich and P. L. Falb Aug. 1975 31 p refs
(Grants AF-AFOSR-2078-71; NSF ENG-73-03846-A01; AF Proj. 9769)
(AD-A016060; AFOSR-75-1375TR) Avail: NTIS CSCL 12/1

This paper is concerned with the development of a complete abstract invariant as well as a set of canonical forms under dynamic compensation for linear systems characterized by proper, rational transfer matrices. More specifically, it is shown that one can always associate with any proper rational transfer matrix, T(s), a special lower left triangular matrix, (Xi sub T)(s), called the interactor. This matrix is then shown to represent an abstract invariant under dynamic compensation which, together with the rank of T(s), represents a complete abstract invariant. A set of canonical forms under dynamic compensation is also developed along with appropriate dynamic compensation. GRA

N76-20907# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
A NOTE ON A SEQUENTIAL SELECTION PROCEDURE WITH APPLICATIONS TO REGRESSION ANALYSIS
Deng-Yuan Huang (Acad. Sinica) Sep. 1975 9 p refs
(Contract N00014-75-C-0455)
(AD-A015700; Mimeo-Ser-439) Avail: NTIS CSCL 12/1

In the past decade a number of fixed sampling methods have been developed for selecting the 'best' or at least a 'good' subset of variable in regression analysis. The author is interested in deriving a sequential selection procedure to select a subset of a random size including all good regression equations. GRA

N76-20908# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SELECTING A REGRESSION ESTIMATOR WITH INTEGRATED MEAN SQUARED ERROR AS A CRITERION Interim Report
Robert L. Mason and Richard F. Gunst 1975 25 p refs
(Grant AF-AFOSR-2871-75; AF Proj. 9769)
(AD-A015909; AFOSR-75-1395TR) Avail: NTIS CSCL 12/1

Integrated mean squared error is employed as a criterion for choosing an estimator of a multiple linear regression model when the regressor variables are multicollinear. Three estimators of the regression coefficients are examined: ordinary least squares, principal components regression, and ridge regression. The integrated variance and integrated squared bias of the corresponding prediction equations are evaluated for a general class of weight functions. Comparisons of the predictors are made on the basis of integrated variance and squared bias separately and combined as integrated mean squared error. GRA

N76-20909# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
ON THE EXISTENCE OF SIMULTANEOUS EDGE DISJOINT REALIZATIONS OF DEGREE SEQUENCES WITH FEW EDGES
D. J. Kleitman (Mass. Inst. of Technol., Cambridge), M. Koren (Penna. Univ.), and S.-Y. Li (Mass. Inst. of Technol.) Aug. 1975 17 p refs
(Contract N00014-67-A-0077-0014; N00014-67-A-0204-0063)
(AD-A016608; TR-269) Avail: NTIS CSCL 12/1

This paper contains the following results. For a sequence A, let (M sub A) be the number of non-zero entries in it; suppose A, B and C - (A+B) are sequences that are the degrees of simple graphs; then if sigma C sub i is less than or equal to 2 (MA + MB - 2), - 2, there exists a realization of C having disjoint factors with degree sequences A and B. At least one of these can be a forest. If A and B are forest realizable, the conditions under which A, B and C can be simultaneously realized with A- and B-factors that are forests are characterized. GRA

N76-20910# Naval Postgraduate School, Monterey, Calif.
NUMERICAL PERFORMANCE OF MATRIX INVERSION WITH BLOCK PIVOTING M.S. Thesis
Gerald G. Brown Aug. 1975 20 p refs
(AD-A016375; NPS-55ZR75081) Avail: NTIS CSCL 12/1

An experiment with matrix inversion using block pivots is presented. Large scale matrix computations can often be performed more efficiently by use of partitioning. Such matrix manipulation lends itself to paged or cache memory systems since computation is staged to be completely performed in local blocks of controllable size. On other systems retrieval overhead can be balanced with computation for 'in-memory/out-of-memory' applications. Parallelism in such schema leads to efficient utilization of some multiple processor environments. Timing results indicate, however, that choice of block size should not necessarily be dictated by hardware page size for most efficient operation and that classical methods of estimating computation times are not always adequate. GRA

N76-20911# Naval Postgraduate School, Monterey, Calif.
REGRESSION ANALYSIS WITH CORRELATED OBSERVATIONS M.S. Thesis
Kyu Ryun Chung Sep. 1975 25 p refs
(AD-A016445) Avail: NTIS CSCL 12/1

The regression model is studied in which the errors are

independent and identically distributed as N(o, sigma squared). Sample observations are correlated with a prescribed correlation structure. It is shown that many of the results available for the independent case are applicable to the correlated sample.Author

N76-20912# Army Missile Command, Redstone Arsenal, Ala. Systems Analysis Office.
EVALUATION OF THE TRIANGULAR DISTRIBUTION INTEGRAL
Charles E. Colvin Sep. 1975 16 p
(AD-A016991; C-TN-75-4) Avail: NTIS CSCL 12/1

The report presents the results of an effort to evaluate, in a closed-form, the triangular probability density function integral. Closed-form integrals are developed for (1) discrete interval probabilities and (2) cumulative probabilities. All of these probabilities are easily determined once the appropriate parameters of the triangular probability density function are known. GRA

N76-21124 European Space Agency, Paris (France).
DISPERSIVE AND DISSIPATIVE PROPERTIES OF A CLASS OF DIFFERENCE SCHEMES FOR NONLINEAR HYPERBOLIC SYSTEMS
Alain Lerat and Roger Peyret *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 1-38 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 61-79 (For availability see N76-21123 11-99)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-20913*# Houston Univ., Tex.
MULTIDIMENSIONAL STOCHASTIC APPROXIMATION USING LOCALLY CONTRACTIVE FUNCTIONS
Wayne M. Lawton (Inst. for Advanced Study) Aug. 1975 13 p refs
(Contract NAS9-12777)
(NASA-CR-147522; Rept-46) Avail: NTIS HC $3.50 CSCL 12A

A Robbins-Monro type multidimensional stochastic approximation algorithm which converges in mean square and with probability one to the fixed point of a locally contractive regression function is developed. The algorithm is applied to obtain maximum likelihood estimates of the parameters for a mixture of multivariate normal distributions. Author

N76-20914*# Houston Univ., Tex. Dept. of Mathematics.
AN ITERATIVE PROCEDURE FOR OBTAINING MAXIMUM-LIKELIHOOD ESTIMATES OF THE PARAMETERS FOR A MIXTURE OF NORMAL DISTRIBUTIONS, ADDENDUM
B. Charles Peters, Jr. and Homer F. Walker Sep. 1975 11 p ref
(Contract NAS9-12777)
(NASA-CR-147521; Rept-47) Avail: NTIS HC $3.50 CSCL 12A

New results and insights concerning a previously published iterative procedure for obtaining maximum-likelihood estimates of the parameters for a mixture of normal distributions were discussed. It was shown that the procedure converges locally to the consistent maximum likelihood estimate as long as a specified parameter is bounded between two limits. Bound values were given to yield optimal local convergence. Y.J.A.

N76-20915# North Carolina Univ., Chapel Hill. Dept. of Statistics.
ON THE ASYMPTOTIC BEHAVIOR OF CERTAIN SUMS OF PROBABILITIES
Walter L. Smith Aug. 1975 38 p refs
(Contract N00014-75-C-0809)
(AD-A015714; Mimeo-Ser-1026) Avail: NTIS CSCL 12/1

The convergence of the infinite series S consisting of the terms L(n).n to the (beta)power. P(S(n)>(x(n) to the (0.5 + alpha) power)) was proved, subject to the following conditions: (1)S(n) is the partial sum of independent random variables Xj, (2) L(n) is a function of slow growth, alpha>(0), (3) beta >(-1), and (4) the (Xj) have finite second moments. It is also shown (under various assumptions, including one that allows the (Xj) to be non-identically distributed) that, as x approaches 0 from above, a specific asymptotic form can be attached to the series. There is also an extension of these results indicated to processes with stationary independent increments. Y.J.A.

N76-20916# Stanford Univ., Calif. Dept. of Operations Research.
A POISSON CONVERGENCE THEOREM FOR A PARTICLE SYSTEM WITH DEPENDENT MOTIONS
P. A. Jacobs Jun. 1975 21 p refs
(Contract N00014-75-C-0267; NR Proj. 047-064)
(AD-A016237; SU-TR-75-15) Avail: NTIS CSCL 12/1

Let X sub n denote the position in R to the d power of the nth particle at time 0. Let Y sub n= [Y sub n (t); t equal to or greater than 0] be a process taking values in R to the d power with Y sub n (0) = 0. The probability law of Y sub n may depend on (X sub n) and [Y sub k; k not equal to n]. Let X sub n (t) = X sub n (t) be the position of the nth particle at time t. Conditions are obtained for the weak convergence of X sub n (t) to a Poisson process as t approaches infinity. Several examples are given, including one of convergence to a clustered Poisson process. Author

N76-20917# Princeton Univ., N.J. Dept. of Statistics.
SIMULTANEOUS T-TESTS IN NORMAL MODELS
David Hunter Jun. 1975 29 p refs
(Contract N00014-75-C-0453)
(AD-A016247; TR-87-Ser-2) Avail: NTIS CSCL 12/1

A method is developed for testing two hypothesis simultaneously. Topics discussed include: statistical distributions; estimation of linear models; and various approximation schemes. Applications of the developed method are cited and examples are given. J.M.S.

N76-20918# George Washington Univ., Washington, D.C. Program of Logistics.
COMPUTING THE VALUE OF THE MAXIMUM LIKELIHOOD ESTIMATE OF THE PARAMETER OF A POISSON DISTRIBUTION TRUNCATED BELOW ONE
Rosedith Sitgreaves 8 Aug. 1975 24 p refs
(Contract N00014-75-C-0729; NR Proj. 347-020)
(AD-A015670; Serial-T-310) Avail: NTIS CSCL 12/1

In attempting to predict the number of demands occurring in a given interval of time for supplies in military inventory systems, it is useful to examine probability models for the distribution of demands for individual items of supply. A first approach in model building for this problem has been to assume that the distribution of demands for a given item is a Poisson distribution, with parameter. However, when Poisson distributions have been fitted to available data, it has been found in many cases that this model tends seriously to underestimate the frequency of periods in which no demands occur. A more general approach is to postulate the existence of two random mechanisms, one governing the occurrence or non-occurrence of demands in the given time period, and the other governing the specific number of demands made, given that demands occur. GRA

N76-20919# Wisconsin Univ., Madison. Mathematics Research Center.
A DERANGEMENT PROBLEM
Richard Askey, Mourad Ismail, and Thanaa Rashed Jun. 1975 15 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-33897)
(AD-A016101; MRC-TSR-1522) Avail: NTIS CSCL 12/1

Even and Gillis found a closed form solution to a derangement problem of (n sub 1) + ... + (n sub k) objects where (n sub i) objects are of type i. Their solution was an integral of products of Laguerre polynomials. A new derivation is given using MacMahon's master theorem and an asymptotic agrument is given to estimate the size of the number of derangements when (n sub 1) = ... = (n sub k) and k is large. It is also shown how Even and Gillis' integral representation follows easily from Kaplansky's symbolic representation of these numbers.
Author (GRA)

N76-20920# California Univ., Los Angeles. Dept. of System Sciences.
ON A CAUSAL AND CAUSALLY INVERTIBLE REPRESENTATION OF EQUIVALENT GAUSSIAN PROCESSES Interim Report
M. Hitsuda and H. Watanabe 1975 32 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-A015851; AFOSR-75-1374TR) Avail: NTIS CSCL 12/1

A causal and causally invertible representation of a Gaussian process (y sub t, 0 equal to or less than t equal to or less than 1) is obtained which is equivalent to a given Gaussian process (x sub t, equal to or less than t equal to or less than 1) on a probability measure space, and a representation of the density which connects these two Gaussian processes is given. Results are generalized to a general class of Gaussian processes. Author

N76-20921# California Univ., Los Angeles. Dept. of System Sciences.
STOCHASTIC CONTROL OF SYSTEMS GOVERNED BY PARTIAL DIFFERENTIAL EQUATIONS Interim Report
A. V. Balakrishnan Aug. 1975 16 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-A015916; AFOSR-75-1377TR) Avail: NTIS CSCL 12/1

A theory is given of stochastic control (Linear Quadratic Regulator) of systems governed by partial differential equations featuring both control and random disturbance on the boundary, exploiting the theory of semigroups of linear operators and using white noise theory in place of Wiener process theory.GRA

N76-20922# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
NONPARAMETRIC SELECTION PROCEDURES FOR SELECTING THE REGRESSION EQUATIONS WITH LARGER SLOPE
Shanti S. Gupta and Deng-Yuan Huang (Acad. Sinica) Sep. 1975 12 p refs
(Contract N00014-75-C-0455)
(AD-A015701; Mimeo-Ser-438) Avail: NTIS CSCL 12/1

Assume that the equation w = beta C + beta 1t describe the weight of animals that were fed a new ration for a given time t. The weight is in grams, and the time is in weeks. The model will be written as y = beta 0 + beta 1 t+e, where beta 0 is the initial weight of an animal and beta 1 is the growth rate. The goal is to find out what kind of ration has the largest growth rate among a set of rations. Application of the results to animal science, economics, and other fields is examined. Author (GRA)

N76-20923# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SUBSET SELECTION PROCEDURES IN ANALYSIS OF VARIANCE
Shanti S. Gupta and Deng-Yuan Huang (Acad. Sinica) Sep. 1975 22 p refs
(Contract N00014-67-A-0226-0014; N00014-75-C-0455)
(AD-A016033; Mimeo-Ser-436) Avail: NTIS CSCL 12/1

In most of the practical situations to which the analysis of variance tests are applied, they do not supply the information that the experimenter aims at. If, for example, the hypothesis is rejected in actual application of the F-test, the resulting conclusion that the true means (theta sub 1), (theta sub 2),...,(theta sub k) are not all equal, would by itself usually be insufficient to satisfy the experimenter. In fact his problems would begin at this stage. He may desire to select the 'best' population or a subset of the 'best' populations; he may like to rank the populations in order of 'bestness' or he may like to draw some other inferences about the parameters of interest to him. The authors interest lies in selecting a non-empty subset of the k populations containing the 'best' population as ranked in terms of (theta sub i's). GRA

N76-20924# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SUBSET SELECTION PROCEDURES FOR REGRESSION ANALYSIS
Shanti S. Gupta and Deng-Yuan Huang (Acad. Sinica) Sep. 1975 14 p refs Prepared in cooperation with Academia Sinica
(Contract N00014-75-C-0455)
(AD-A016031; Mimeo-Ser-437) Avail: NTIS CSCL 12/1

In the past decade a number of methods have been developed for selecting the 'best' or at least a 'good' subset of variables in regression analysis. For various reasons, one may be interested in selecting a random size subset excluding all inferior independent variables. The authors are interested in deriving a selection procedure to the goal. Some results on the efficiency of the procedure are also discussed. GRA

N76-20925# RAND Corp., Santa Monica, Calif.
THE FOUNDATIONS OF PROBABILITY AND MATHEMATICAL STATISTICS
Gus W. Haggstrom Mar. 1975 144 p refs
(AD-A016496; P-5394) Avail: NTIS CSCL 12/1

These notes were written for an introductory course in probability and statistics at the post-calculus level that was presented during the fall term of 1974 to students in the Rand Graduate Institute. Most of the material is devoted to the basic concepts of probability theory that are prerequisite to learning mathematical statistics: probability models, random variables, expectation and variance, joint distributions, conditioning, correlation, and sampling theory. Among the distributions treated are the binomial, hypergeometric, Poisson, negative binomial, normal, gamma, lognormal, chi-square, and bivariate normal. The last section of the notes provides an introduction to some of the basic notions of parameter estimation: bias, efficiency, sufficiency, completeness, consistency, maximum likelihood, and least-squares estimation. Proofs of the Rao-Blackwell, Lehmann-Scheffe, and Gauss-Markov Theorems are included. GRA

N76-20926# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SAMPLE SIZE DETERMINATION FOR A RANDOM VARIABLE OF BOUNDED VARIATION
J. Richard Moore Sep. 1975 13 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A016902; BRL-1833) Avail: NTIS CSCL 12/1

A procedure for determining the sample size required to estimate the mean of a random variable of bounded variation is given and its use is illustrated via two examples, one a computer simulation problem and the other a field experiment. GRA

N76-20927# Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE POWER OF THE EXTREME SPREAD
Malcolm S. Taylor Sep. 1975 16 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A016907; BRL-MR-2534) Avail: NTIS CSCL 21/1

A variety of techniques are available for testing whether a random sample might reasonably be assumed to have come from a normal population. If, however, the random sample is a bivariate random sample the number of choices is greatly reduced. The purpose of this note is to suggest a new statistic for testing the hypothesis of bivariate normality in the case of known sigma which is easily computed and whose power seems to be far superior to the classical chi-square test, and in addition, may be used with small sample sizes, where the chi-square test is inappropriate. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-20928 Georgia Inst. of Tech., Atlanta.
NEW RESULTS ON DISCRETE-TIME TIME-VARYING LINEAR SYSTEMS Ph.D. Thesis
Khaled Mohammad Hafez 1975 94 p
Avail: Univ. Microfilms Order No. 75-26207

An investigation is made of an algebraic approach toward the study of discrete-time time-varying linear systems. The approach is based on a module structure over skew polynomial rings. The thesis first adopts a global-in-time representation consisting of viewing the system coefficient matrices as elements of an arbitrary difference ring of time functions. The concepts of semilinear transformations and skew polynomial rings are then

introduced and a module structure emerges as a consequence of incorporating the theory of noncommutative difference polynomials into the state variable description. This algebraic structure is used to study various properties of discrete-time time-varying linear systems and is applied to control design problems. In particular, via the construction of a characteristic polynomial in the time-varying case, results on state variable feedback and stabilization are given in the single input case. A global-in-time duality theory, termed T-duality, is introduced. Dissert. Abstr.

N76-20929*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

SOME EXISTENCE AND SUFFICIENT CONDITIONS OF OPTIMALITY

Touraj Assefi 15 Feb. 1976 24 p refs

(Contract NAS7-100)

(NASA-CR-146576; JPL-TM-33-764) Avail: NTIS HC $3.50 CSCL 12B

The role of the existence and sufficiency conditions in the field of optimal control was briefly described. The existence theorems are discussed for general nonlinear systems. However, the sufficiency conditions pertain to 'nearly' linear systems with integral convex costs. Moreover, a brief discussion of linear systems with multiple-cost functions is presented. Author

N76-20930# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

THE INTERFACE MESSAGE PROCESSOR PROGRAM

Sep. 1975 133 p refs

(Contracts DAHC15-69-C-0179; F08606-75-C-0032; F08606-73-C-0027)

(AD-A016306; Technical-Information-89-Rev) Avail: NTIS CSCL 09/2

The ARPA Network has been in operation for over five years and has become an international facility. The network has grown to more than 60 sites spread across the continental United States, plus satellite connections to Hawaii, Norway, and England, and is steadily growing; approximately ninety independent computer systems of varying manufacture are interconnected. Provision has been made for terminal access to the network from sites which do not enjoy the ownership of an independent computer system. Implementation of the IMPs required the development of a sophisticated computer program. This program has been previously described in previous papers. As stated then, the principal function of the IMP program is the processing of packets, including the following: segmentation of Host messages into packets; receiving, routing, and transmitting store-and-forward packets; retransmitting unacknowledged packets; reassembling packets into messages for transmission into a Host; and generating RFNMs and other control messages. The program also monitors network status, gathers statistics, and performs on-line testing. GRA

N76-20931# Honeywell Information Systems, Inc., McLean, Va.

TPAP OPERATING SYSTEM EXECUTIVE Final Report, Sep. 1974 - Jun. 1975

R. Ewing Aug. 1975 282 p refs

(Contract F30602-74-C-0138; AF Proj. 5581)

(AD-A016438; RADC-TR-75-212) Avail: NTIS CSCL 09/2

This report describes a special purpose, virtual operating system designed to enhance the flexibility and capability of the Transaction Processing System within the Honeywell Series 60/6000/600 Information Systems. The special purpose operating system is called the TPAP Operating System (TPOS). The TPOS was developed as a specialized software system that virtually controls an assigned subset of the total computer environment for the exclusive multi-programmed execution of a selected set of Transaction Processing Applications Programs. Functionally, the TPOS resembles a time sharing system. More than one TPOS can be incorporated in a Transaction Processing System. The report includes the user, site and program logic documentation. The user and site guidelines are provided to install and use a TPOS. The program logic sections document design objectives and techniques, modular structure and control table definitions of the TPOS Executive program. GRA

N76-20932# Pattern Analysis and Recognition Corp., Rome, N.Y.

RADC ON-LINE RETRIEVAL SYSTEM EVALUATION Final Report, Jul. 1973 - Mar. 1975

John M. Morris, Clifford Carroll, and Richard Jayne Aug. 1975 117 p refs

(Contract F30602-73-C-0389; AF Proj. 4594)

(AD-A016436; PAR-75-10; RADC-TR-75-208) Avail: NTIS CSCL 09/2

This report presents the results of comprehensive statistical and operational testing of the RADCOL retrieval system. Section 1 of the report presents an overview of the system, with emphasis on retrieval methodology, and with some discussion of the effectiveness of this methodology. Section 2 describes the techniques for statistical testing which were developed especially for this project. They permit objective tests of retrieval effectiveness for large data bases, which may not permit a complete search to determine the number of documents relevant to a particular query. Section 3 presents the results of operational testing of the RADCOL system. In Section 4, the RADCOL system is compared with several standard retrieval systems, in an attempt to determine those features that might be most useful in future development of the system. Section 5 presents a more detailed discussion of possible modifications and expansions of the system, as it might be implemented in an operational environment. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-20933*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

COEFFICIENTS OF ASSOCIATED LEGENDRE FUNCTIONS

Quintin D. Peasley Washington Apr. 1976 61 p

(NASA-TN-D-8200) Avail: NTIS HC $4.50 CSCL 12A

The exact coefficients for the explicit forms of the associated Legendre functions Pm for integer values of m,n = 0,1,2,...25 are presented in tabular form together with two cross-referenced listings of the zeroes for these functions rounded to five decimal places. The unfactored coefficients and the interger coefficients are presented in adjacent columns for each function. The greatest common factor and divisor have been removed and listed separately for the integer coefficients. Author

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-20934# Istituto Universitario Navale, Naples (Italy). Lab. di Onde Elettromagnetiche.

STUDY OF HIGH FREQUENCY DIFFRACTION FROM NON-PERFECTLY CONDUCTING SURFACES Final Report

31 Jul. 1975 68 p refs Prepared jointly with Naples Univ.

(Contract ESTEC-2146/74-HP)

(ESA-CR(P)-734) Avail: NTIS HC $4.50

A study was carried out of high frequency diffraction from non-perfectly conducting surfaces with the object of determining solar array electromagnetic scattering properties. The Maliuzhinetz function for the problem of electromagnetic scattering by a half plane with two different face impedances is presented and exploited in some detail for diffraction problems. The scattering properties of solar cell panels for satellites are experimentally investigated. For individual titles, see N76-20935 through N76-20937.

N76-20935 Istituto Universitario Navale, Naples (Italy).

ELECTROMAGNETIC SCATTERING BY HALF-PLANE WITH TWO FACE IMPEDANCES

Ovidio M. Bucci and Giorgio Franceschetti *In its* Study of High Frequency Diffraction From Non-perfectly Conducting Surfaces 31 Jul. 1975 p 1-28 refs Sponsored in part by CNR (For availability see N76-20934 11-70)

The Maliuzhinetz solution for the problem of electromagnetic scattering by a half-plane with two different face impedances is presented for both normal and oblique incidence. Illustrative examples are discussed and a chart relative to the existence of surface wave contributions reported. Author (ESA)

N76-20936 Istituto Universitario Navale, Naples (Italy).
ON A FUNCTION OCCURRING IN THE THEORY OF SCATTERING FROM AN IMPEDANCE HALF-PLANE
Ovidio M. Bucci *In its* Study of High Frequency Diffraction from Non-perfectly Conducting Surfaces 31 Jul. 1975 p 29-40 refs (For availability see N76-20934 11-70)

The properties of a function first introduced by Maliuzhinetz, which is relevant to the study of scattering from a half plane with boundary condition of the impedance type, are exploited in some detail. Numerical tables and graphs are presented for the function in the range which is relevant to diffraction problems. This should be useful for analysis of scattering from complex lossy structures. Author (ESA)

N76-20937 Istituto Universitario Navale, Naples (Italy).
ELECTROMAGNETIC SCATTERING PROPERTIES OF SOLAR-CELL PANELS TO BE USED ON SATELLITES
Paolo Corona, Guglielmo DAmbrosio, and Giorgio Franceschetti *In its* Study of High Frequency Diffraction from Non-perfectly Conducting Surfaces 31 Jul. 1975 p 41-62 refs (For availability see N76-20934 11-70)

The scattering properties of solar cell panels to be used on satellites are experimentally investigated. Measurements are made on individual solar cells inserted into waveguides (KU band) and then on solar cell panels in an anechoic room. The possibility of describing the surface properties of the solar cell panel as an imperfect conductor is demonstrated. Author (ESA)

N76-20938# Cincinnati Univ., Ohio.
USER'S MANUAL FOR UCIN-SUPER, CHAIN SYSTEMS Interim Report, 1 Jan. - 31 Dec. 1974
Ronald L. Huston, Mark W. Harlow, Chris E. Passerello, and James M. Winget 1 Apr. 1975 37 p refs
(Grant NSF GK-41272)
(PB-247059/9; UC-EA-040175-4-NSF) Avail: NTIS HC $4.00 CSCL 20K

A user's manual is presented for a computer program, UCIN-SUPER-CHAIN SYSTEMS. The program is designed to study the dynamics of open chains of general chain systems. A general chain system is a series of rigid bodies arbitrarily assembled with adjoining bodies sharing a common point, and no closed loops formed. The manual provides detailed instruction for input card images and output data for the program. GRA

N76-21143 Battelle Inst., Frankfurt am Main (West Germany).
EXPLOSIVE DRIVEN GAS COMPRESSION IN AN AXISYMMETRIC HARD-CORE DEVICE
W. Geiger and G. Honcia *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 195-206 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-20939* Societe Bertin et Cie, Plaisir (France). Lab. d'Acoustique et Propulsion.
NOISE IN INDUSTRIAL VENTILATORS Final Report [ETUDE GENERALE DU BRUIT DES VENTILATEURS INDUSTRIELS]
G. H. Saurier and C. Doyotte Sep. 1974 102 p refs In FRENCH; ENGLISH summary
(Contract DGRST-72-7-0663)
Avail: NTIS HC $5.50

A law for the overall radiated acoustic power by an axial fan is sought. It is shown that if the acoustic analogy remains applicable and the peripheric Mach number is low then a transposition of methods used in aeronautics is possible. The sound field may be calculated and the radiated power simply expressed as a function of geometry and required performances. A theoretical and experimental study of optimization and non-uniform upstream flow are presented. The up and downstream noise directivity, the influence of solid boundaries on the generated upstream noise, and the influence of the downstream duct on overall radiated noise are discussed. ESA

N76-20940*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTION OF LIGHT AIRCRAFT INTERIOR NOISE
James T. Howlett and David A. Morales Apr. 1976 21 p refs
(NASA-TM-X-72838) Avail: NTIS HC $3.50 CSCL 20A

A computerized interior noise prediction method for light aircraft is described. An existing analytical program, development for commercial jets, forms the basis of some modal analysis work which is described. The accuracy of this modal analysis technique for predicting low-frequency coupled acoustic-structural natural frequencies is discussed along with trends indicating the effects of varying parameters such as fuselage length and diameter, structural stiffness, and interior acoustic absorption. Author

N76-20941*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPARISON OF MATRIX METHODS FOR CALCULATING EIGENVALUES IN ACOUSTICALLY LINED DUCTS
Willie Watson and Donald L. Lansing Washington Mar. 1976 47 p refs
(NASA-TN-D-8186; L-10607) Avail: NTIS HC $4.00 CSCL 20A

Three approximate methods - finite differences, weighted residuals, and finite elements - were used to solve the eigenvalue problem which arises in finding the acoustic modes and propagation constants in an absorptively lined two-dimensional duct without airflow. The matrix equations derived for each of these methods were solved for the eigenvalues corresponding to various values of wall impedance. Two matrix orders, 20 x 20 and 40 x 40, were used. The cases considered included values of wall admittance for which exact eigenvalues were known and for which several nearly equal roots were present. Ten of the lower order eigenvalues obtained from the three approximate methods were compared with solutions calculated from the exact characteristic equation in order to make an assessment of the relative accuracy and reliability of the three methods. The best results were given by the finite element method using a cubic polynomial. Excellent accuracy was consistently obtained, even for nearly equal eigenvalues, by using a 20 x 20 order matrix. Author

N76-20942# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
THE AMPLIFICATION OF BROADBAND JET NOISE BY PURE TONE EXCITATION
Dietrich Bechert and Eberhard Pfizenmaier 6 Nov. 1975 25 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-75-72) Avail: NTIS HC $3.50; DFVLR, Cologne DM 10,40

It was found experimentally that broad band jet noise can be amplified as much as 6 to 7 dB. The jet noise amplification effect takes place at sound pressure levels present in real aircraft engines. The experimental investigation was restricted to a cold jet at high subsonic Mach numbers excited by a plane sound wave coming from inside the nozzle. Based on a simplified mathematical model an attenuator was developed which reduces the jet noise amplification significantly. Author (ESA)

N76-20943# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Trauen (West Germany). Inst. fuer Technische Akustik.
FREE JET TEST STAND FOR AEROACOUSTIC MODEL EXPERIMENTS
Werner Dobrzynski 3 Nov. 1975 35 p ref In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-Mitt-75-22) Avail: NTIS HC $4.00; DFVLR, Cologne DM 14.60

The stand consists of an acoustic plenum chamber, followed by a convergent square nozzle of 0.09 sq m cross-sectional area with subsequent flat plate for the attachment of test objects. Maximum free jet speed is 60 m/s. Measurements of velocity profiles and turbulence intensities served to check the aerodynamic quality of the free jet and to identify optimum locations for test objects. The noise floor of the operational test stand was determined for various free jet speeds; typical signal to noise ratios were obtained using several representative test objects. Possibilities are discussed to improve the aerodynamic quality of the flow and lower the noise floor. Author (ESA)

N76-20944# National Bureau of Standards, Washington, D.C. Applied Acoustics Section.

PROCEDURES FOR ESTIMATING SOUND POWER FROM MEASUREMENTS OF SOUND PRESSURE. AN EXPERIMENTAL INVESTIGATION WITH APPLICATION TO NOISE FROM PORTABLE AIR COMPRESSORS Final Report, Feb. - Dec. 1974

Curtis I. Holmer Jan. 1975 79 p refs

(COM-75-11399/3; NBSIR-75-652; EPA-550/8-76-001) Avail: NTIS HC $5.00 CSCL 20A

Investigations of the accuracy and precision of various measurement methodologies for determining the estimated sound power output of large machines in the free field over a reflecting plane are described. One purpose of this investigation is to place empirical error bounds on many of the free field measurement procedures currently proposed or in use. In particular, the results of near field and far field measurements are compared. The sources used for the investigation included 17 portable air compressors of various types a reference sound source, and a loudspeaker driven by a pure tone source. GRA

N76-21127 European Space Agency, Paris (France).

CHARACTERIZATION OF THE SOUND FIELD OF A HOT JET FROM ITS INFRARED EMISSION

Jean-Francois DeBelleval *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 84-101 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-2, Mar.-Apr. 1975 P 105-115 (For availability see N76-21123 11-99)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-20945 Stanford Univ., Calif.

PHYSICS, ELEMENTARY PARTICLES AND HIGH ENERGY: ELECTRON SCATTERING OF HYDROGEN AND DEUTERIUM AT 50 DEG AND 60 DEG Ph.D. Thesis

William Bradford Atwood 1975 228 p

Avail: Univ. Microfilms Order No. 76-5689

The inelastic scattering of electrons for both protons and neutrons has been measured at scattering angles of fifty and sixty degrees and for incident energies between 6.5 GeV and 19.5 GeV. Elastic scattering from protons was also observed. The measurements were made at the Stanford Linear Accelerator Center using the 1.6 GeV spectrometer located in End Station A. The experimental techniques used in making the measurements are detailed. The resulting cross sections are large, indicative of a charged point-like substructure within the nucleon and match the extrapolation from previous measurements to the new kinematic region to within forty percent. The measurements are found to be compatible with some existing theoretical expectations. The elastic scattering measurements are consistent with an inverse fourth power dependence on four-momenta transfer. The measured neutron-proton ratio is in agreement with previous measurements. Dissert. Abstr.

N76-20946 Wisconsin Univ., Madison.

PRESSURE EFFECTS OF NEUTRAL EXCITATIONS PRODUCED IN ELECTRON-BOMBARDED LIQUID HELIUM Ph.D. Thesis

Franciso Javier Soley 1975 124 p

Avail: Univ. Microfilms Order No. 75-26527

The absorption and emission spectra of electron-bombarded liquid helium were studied as a function of pressure between the saturated vapor pressure and 25 atm. The transitions of He^* and He2 in the liquid shift toward the blue with increasing pressure. The observed pressure shifts of atomic transitions were compared with calculations based on the bubble model of excited states of helium in liquid helium. The observed pressure dependence of the linewidth and shift for the He 2 sup 3 P (2 sup 3 S) and He(3 sup 3 P) transitions were in good agreement with static line broadening calculations. A strong pressure-dependent quenching of the excited atomic and molecular states in the liquid was also observed. The pressure dependence of the bilinear recombination coefficient for the He2 (a sup 3 sigma) metastable molecule in liquid helium was also measured. The results were interpreted within the context of diffusion limited reactions. An attempt was made to trap the molecular metastables in solid helium. Dissert. Abstr.

N76-20947*# California Univ., Los Angeles. Molecular-Beam Lab.

RESEARCHES ON INTERACTIONS OF SATELLITE-SPEED HELIUM ATOMS WITH ALUMINUM AND QUARTZ SURFACES Final Report, 25 Mar. - 25 Dec. 1975

Shih-Min Liu and Eldon L. Knuth Jan. 1976 68 p refs

(Grant NGR-05-007-416)

(NASA-CR-146657) Avail: NTIS HC $4.50 CSCL 20H

Three major areas were experimentally studied: (1) energy transfer in collisions of satellite-speed (700 m/sec) helium atoms with a cleaned satellite-type aluminum surface was investigated using the molecular-beam technique. Spatial and energy distributions of reflected helium atoms were measured and analyzed, (2) The gross accommodation coefficient for a satellite-speed (7000 m/sec) helium beam entering a 2-inch-diameter aluminum spherical cavity was determined by measuring the exit velocity distribution of the leaving helium atoms using a metastable time-of-flight method. Results indicate that the 7000-m/sec satellite-speed helium atoms entering the cavity gain full accommodation with the room-temperature inner surface of the sphere through a large number of collisions before leaving the spherical cavity; and (3) the feasibility of producing a satellite-speed atomic hydrogen beam by arc-heating, for use in studies of interactions of satellite-surfaces with hydrogen atoms under laboratory conditions, was investigated. It was found that a stable arc-heated molecular hydrogen beam can be obtained using the arc-heater, and that a partially dissociated hydrogen beam can be produced. Photographs of laboratory equipment are shown. Author

N76-20948# Battelle Inst., Frankfurt am Main (West Germany).

A STUDY ON POSITIONING OF MOLTEN MATERIALS IN 'ZERO' GRAVITY ENVIRONMENT BY ULTRASONIC METHODS, PHASE 2

E. G. Lierke and R. Grossbach Nov. 1975 100 p refs

(Contract ESA-SC/67-HQ)

(BF-R-30.996-2; ESA-CR(P)-752) Avail: NTIS HC $5.00

Multiaxial positioning of spherical samples in cylindrical tubes (tube furnace 30 to 50 mm in diameter) at an operating temperature of 1200 C was investigated. The positioning is based on the excitation of standing waves with one node circle, which provide both axial and radial positioning forces and can be generated by a single piston transducer from one tube end. Resonance is maintained by motor driven adjustment of a rigid reflector at the other tube end, using the phase locking technique. The following is discussed: basic theory; special design problems of the tube levitator; sample heating; ultrasonic transmitter; mechanical manipulator; removing processed samples from furnace without contact; and deformation of velocity profiles at the sphere-danger of sputtering. ESA

N76-20949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.

A COMPUTER PROGRAM FOR THE CALCULATION OF RELATIVE EMISSION COEFFICIENTS OF DIATOMIC MOLECULES IN THE HIGH TEMPERATURE RANGE

Lutz Krauss and Horst Rittwagen 23 Oct. 1975 51 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-Mitt-75-19) Avail: NTIS HC $4.50; DFVLR, Cologne DM 23.60

The universal NASA computer program CEC 71 commonly used for the calculation of chemical equilibria at high temperatures, based on JANAF data, was extended for external input of spectroscopic data of atoms and diatomic molecules for calculating their thermodynamic functions. This means an advantage for checking molecular values from the literature in their significance to computer results of calculated equilibrium concentrations. All input data can be altered arbitrarily. Since all thermodynamic functions of diatomic molecules can be solved analytically, there exists no upper temperature limit arising by the polynomial coefficient procedure of the original program. Some examples of calculation of internal partition functions, number densities, and emission coefficients of spectral lines and molecular bands under different conditions are given. Author (ESA)

N76-20950# National Bureau of Standards, Washington, D.C. Center for Radiation Research.
INTERACTIONS OF HIGH ENERGY PARTICLES WITH NUCLEI Final Report
Wieslaw Czyz Sep. 1975 76 p refs
(COM-75-11366/2; NBS-Mono-139) Avail: NTIS HC $4.75 CSCL 20H

Elastic scattering and diffractive production processes induced in nuclear targets by high energy projectiles are discussed. Special attention is paid to the interaction of high energy hadrons and photons. Interactions of high energy electrons and neutrinos are briefly mentioned. The common features of all these processes are emphasized throughout the article: The multiple scattering and shadowing processes inside of the target nuclei. An effort is made to develop a unified way of treating nuclear interactions of particles which are either hadrons or exhibit some hadronic components in such interactions. GRA

N76-20951# Democritus Nuclear Research Center, Athens (Greece). Chemistry Dept.
INTRAMOLECULAR PROTON REACTIONS IN THE EXCITED STATE: THE PHOTOCHEMISTRY OF HETEROCYCLIC SCHIFF BASES Final Technical Report, 1 Jun. 1974 - 1 Jun. 1975
Eugene Hadjoudis and Dina Gegiou-Hadjoudis Jun. 1975 24 p refs
(Grant DA-ERO-124-74-G0073; DA Proj. 2O0-61105-B-13B) (AD-A013507; ARDG(E)-R/D-2127) Avail: NTIS CSCL 07/3

The photochemistry and spectra of a number of heterocyclic Schiff bases have been investigated in the crystalline state (polycrystalline powders and thin films), in rigid glasses and in solution, in a variety of solvents over a range of temperatures and solute concentrations. All the compounds studied in the crystalline state are found to be thermochromic; a number of them present the phenomenon of negative thermochromism. All these compounds are photo-colourable (photochromic) in rigid glasses at low temperatures. Photochromism, in this class of compounds, is a property of the isolated molecule in an arbitrary rigid matrix involving proton transfer leading to quinoid type molecules. Author (GRA)

N76-20952# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
BIBLIOGRAPHY ON ATOMIC LINE SHAPES AND SHIFTS (JULY 1973 - MAY 1975), SUPPLEMENT 2
J. R. Fuhr, G. A. Martin, and B. J. Specht Nov. 1975 78 p
(PB-246714/0; NBS-SP-366-Suppl-2; LC-72-600147) Avail: NTIS HC $5.00 CSCL 07D

This is the second supplement to the NBS Special Publication 366, Bibliography on Atomic Line Shapes and Shifts (1889 through March 1972). It contains about 400 references and covers the literature from July 1973 through May 1975. GRA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N76-20953# Princeton Univ., N.J. Plasma Physics Lab.
EFFECT OF PLASMA PHYSICS ON CHOICES OF FIRST WALL MATERIALS AND STRUCTURES FOR A THERMONUCLEAR REACTOR
D. M. Meade 1975 22 p refs Presented at Intern. Conf. on Radiation Test Facilities for the CTR Surface and Mater. Program Argonne, Ill., 15 Jul. 1975 Sponsored by ERDA
(CONF-750723-17) Avail: NTIS HC $4.25

Impurity ions adversely affect the behavior of present-day Tokamaks, and control of impurities is expected to be a key element in determining the feasibility of thermonuclear fusion reactors. A description is given of the plasma-surface interactions for Tokamaks and several techniques for controlling impurities. The plasma-surface problem of next generation devices PLT, PDX, DIII and TFTR is expected to be similar to those encountered in a reactor. For these devices calculations indicate that most of the particle energy efflux will be in the 1 keV region. Author (NSA)

N76-20954# Oak Ridge National Lab., Tenn.
NUCLEAR STRUCTURE DATA FILE: A MANUAL FOR PREPARATION OF DATA SETS
W. B. Ewbank, M. R. Schmorak, F. E. Bertrand, M. Feliciano, and D. J. Horen Jun. 1975 34 p
(Contract W-7405-eng-26)
(ORNL-5054) Avail: NTIS HC $4.00

The Nuclear Data Project is building a computer-based file of nuclear structure data, which is intended for use by both basic and applied users. For every nucleus, the Nuclear Structure Data File contains evaluated nuclear structure information. This manual describes a standard input format for nuclear structure data. The format is sufficiently structured that bulk data can be entered efficiently. At the same time, the structure is open-ended and can accommodate most measured or deduced quantities that yield nuclear structure information. Computer programs have been developed at the Data Project to perform consistency checking and routine calculations. Programs are also used for preparing level scheme drawings. NSA

N76-20955# Oak Ridge National Lab., Tenn.
ATOMIC PHYSICS IN THE CONTROLLED THERMONUCLEAR RESEARCH PROGRAM
C. F. Barnett 1975 8 p Presented at the 8th Intern. Conf. on Phys. of Electron. and Atomic Collisions, Seattle, 24 Jul. 1975 Sponsored by ERDA
(CONF-750705-4) Avail: NTIS HC $4.00

The atomic processes involving plasma heating, cooling, and diagnostics as related to Tokomak-type devices are discussed. Author NSA

74 OPTICS

Includes light phenomena.

N76-20956 Stanford Univ., Calif.
PHYSICS, OPTICS: OPTICAL FREQUENCY CONVERSION IN METAL VAPORS Ph.D. Thesis
David Michael Bloom 1975 78 p
Avail: Univ. Microfilms Order No. 76-5693

Phasematched third harmonic generation in sodium and rubidium vapor using both an inert gas and a second metal vapor for phasematching is demonstrated. Energy conversion efficiencies of 10% have been obtained and factors limiting conversion efficiencies are discussed. Theoretical analysis for a resonantly two-photon pumped frequency converter with application to the generation of tunable ultraviolet and vacuum ultraviolet radiation and also to infrared-to-visible up-conversion

and imaging is presented. Calculations show that up-conversion power efficiencies in excess of 100% should be obtainable with tunable lasers having peak powers in the hundred watt to kilowatt range. Efficient up-conversion of low-level infrared radiation near 10 micrometers to the near ultraviolet employing resonant two-photon pumping of a non-allowed transition in sodium vapor is demonstrated. Dissert. Abstr.

N76-20957 Seton Hall Univ., South Orange, N.J.
AN INSTRUMENT FOR THE SIMULTANEOUS MEASUREMENT OF ABSORBANCE, OPTICAL ROTATORY DISPERSION AND CIRCULAR DICHROISM Ph.D. Thesis
Domenick V. Amato 1975 102 p
Avail: Univ. Microfilms Order No. 76-1272

The approach to the design of the instrument was to modulate a polarized light beam after its passage through the sample by means of rotation of the plane of polarization and then demodulation of the signal resulting from passage through the sample and analyzer polarizer. The rotating plane of polarized light is observed as a sine wave after passage through the analyzer polarizer. Optical rotation is measured as the phase difference between the sine wave generated by passage through an optically active sample and the sine wave generated by passage through a reference not containing the optically active material under observation. Absorbance is measured by taking the log of the ratio of the maximum value of the sample sine wave to the maximum value of the reference sine wave. Dissert. Abstr.

N76-20958* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
METHOD AND APPARATUS FOR COMPENSATING REFLECTION LOSSES IN A PATH LENGTH MODULATED ABSORPTION-ABSORPTION TRACE GAS DETECTOR Patent
John Dimeff, inventor (to NASA) Issued 9 Mar. 1976 6 p Filed 15 Oct. 1974 Supersedes N74-34864 (12 - 24, p 2948)
(NASA-Case-ARC-10631-1; US-Patent-3,943,368; US-Patent-Appl-SN-514546; US-Patent-Class-250-573; US-Patent-Class-250-343) Avail: US Patent Office CSCL 20F

A method and apparatus is described for determining the density of a reference gas in an unknown gas. The apparatus is comprised of (1) a chamber for containing a gas including a reference gas at a known partial density, (2) a chamber for containing a gas including a sample of the reference gas at an unknown partial density, (3) a source of radiant energy and, (4) a chopper wheel comprised of gas cells containing a sample of the reference gas and gas cells containing a gas excluding the reference gas. The path length of the radiant energy in the chambers in modulated and the radiant energy and the position of the chopper cells with respect to the radiant energy path are sensed providing a signal proportional to the density of the reference gas in the unknown gas sample.
Official Gazette of the U.S. Patent Office

N76-20959*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPTICAL INSTRUMENT EMPLOYING RETICLE HAVING PRESELECTED VISUAL RESPONSE PATTERN FORMED THEREON Patent Application
Richard F. Haines, inventor (to NASA) Filed 8 Mar. 1976 19 p
(NASA-Case-ARC-10976-1; US-Patent-Appl-SN-665032) Avail: NTIS HC $3.50 CSCL 20F

A hand held optical instrument for use in locating indicator lights for the like on a work surface is described. The device provides a reflective reticle including a reference pattern and a plurarity of contours each representative of a given iso-response time for an average viewer to respond to a light of a preselected color. NASA

N76-20960*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NOISE LIMITATIONS OF MULTIPLIER PHOTOTUBES IN THE RADIATION ENVIRONMENT OF SPACE
Walter Viehmann and Alfred G. Eubanks Washington Mar. 1976 32 p refs
(NASA-TN-D-8147; G-7632) Avail: NTIS HC $4.00 CSCL 20F

The contributions of Cerenkov emission, luminescence, secondary electron emission, and bremsstrahlung to radiation-induced data current and noise of multiplier phototubes were analyzed quantitatively. Fluorescence and Cerenkov emission in the tube window are the major contributors and can quantitatively account for dark count levels observed in orbit. Radiation-induced noise can be minimized by shielding, tube selection, and mode of operation. Optical decoupling of windows and cathode (side-window tubes) leads to further reduction of radiation-induced dark counts, as does reducing the window thickness and effective cathode area, and selection of window/cathode combinations of low fluorescence efficiency. In trapped radiation-free regions of near-earth orbits and in free space, Cerenkov emission by relativistic particles contributes predominantly to the photoelectron yield per event. Operating multiplier phototubes in the photon (pulse) counting mode will discriminate against these large pulses and substantially reduce the dark count and noise to levels determined by fluorescence. Author

N76-20961*# National Aeronautics and Space Administration, Washington, D.C.
OPTICAL DEVICES: A COMPILATION Technology Utilization
Jan. 1976 28 p ref
(NASA-SP-5965(01)) Avail: NTIS HC $1.00 CSCL 20F

Technological developments in the field of optics devices which have potential utility outside the aerospace community are described. Optical instrumentation, light generation and transmission, and laser techniques are among the topics covered. Patent information is given. J.M.S.

N76-20962# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS OF THE OUTPUT NOISE INDUCED BY ACOUSTO-OPTIC CAVITY DUMPING OF A Nd:YAG LASER M.S. Thesis
Michael A. Lemons Mar. 1975 57 p refs
(AD-A017184; GEO/PH/75-7) Avail: NTIS CSCL 20/6

An experimental study was made on the amount of noise introduced into the output of an acousto-optic cavity dumped Nd:YAG laser. The minimum output intensity pulse increased as the cavity dumping percentage increased. This continued up to a cavity dumping percentage of 15%. A comparison was made between a computer simulation and the experimental data. These compared favorably until the dumping percentage exceeded 15%. An analysis was made of the effects on the varying output intensities on a satellite communication link. The results showed that the laser communication link was practical. GRA

N76-20963# New Mexico State Univ., University Park. Dept. of Physics.
RESEARCH IN THE AREA OF ATMOSPHERIC MODELING: HIGH RESOLUTION ATMOSPHERIC IR TRANSMITTANCE PREDICTION Report for 1 Oct. 1974 - 30 Jun. 1975
August Miller, Robert L. Armstrong, and Charles W. Welch 1 Jul. 1975 128 p refs
(Contract DAAD07-73-C-0134)
(AD-A017026; NMSU-PHYS-537-75-1) Avail: NTIS CSCL 20/6

An atmospheric IR transmittance prediction model which includes the effects of high resolution molecular absorption, certain molecular continuum absorption, Rayleigh scattering and single and multiple scattering by spherical, polydisperse aerosol materials is summarized. The multiple-scattering codes are discussed in some detail, as are its current limitations. Representative results obtained for three aerosol models are presented, together with descriptions of conclusions which may be drawn from them. In addition, the effects on transmittance of using generalized Voight line shape profile are discussed. Complete FORTRAN IV source code listings, as well as UNIVAC 1108 running instructions are appended. GRA

N76-20964# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
OPERATIONS MANUAL FOR MICROWAVE MODULATED DUAL OPTICAL DISTANCE-MEASURING INSTRUMENT

Final Report
K. B. Earnshaw, G. M. B. Bouricius, and K. P. Moran Jul. 1975 126 p
(PB-247364/3; NOAA-TR-ERL-341; WPL-42; NOAA-75111304) Avail: NTIS HC $6.00 CSCL 20F

The accuracy of optical distance measurements on horizontal paths is limited at present by uncertainty in knowledge of the average air density along the path. The development and testing of a prototype instrument capable of significantly greater accuracy, probably as high as 0.1 ppm is described. The instrument makes simultaneous measurements of transit time using to superimposed beams of light which have different optical wavelengths but which are modulated at a common microwave frequency. From the difference in transmit time for the two colors, plus the absolute transit time for either one, the average refractive index along the path and hence the true geodetic path length can be determined. Tests over a 6.2 -km path have given a standard error of 0.3 ppm in corrected distance, and it is believed that even better results can be obtained. The system is decribed, including proposed modifications that would significantly increase its accuracy and range. GRA

N76-20965# Little (Arthur D.), Inc., Cambridge, Mass.
THEORY OF ABSORPTION AND SCATTERING BY LOSSY DIELECTRIC PARTICLES Final Report
J. R. Aronson, A. G. Emslie, and P. F. Strong Jul. 1975 42 p refs
(Grant NOAA-03-4-022-121)
(PB-246965/8; ADL-C-77329; NOAA-75102902) Avail: NTIS HC $4.00 CSCL 20F

The absorption and scattering properties of particulate materials are important in a variety of atmospheric problems. These include radiative transfer calculations which are important in climatology and remote sensing applications which are related to atmospheric pollution. The usual approach to calculation of the absorption and scattering properties of particulates is that of the Mie theory. Recently, a modification of the theory has been applied to interpret the infrared spectra obtained by Mariner 9. This theory is capable of handling statistical distributions of particles of differing shapes. Perhaps the most novel and important conclusion was the concept of enhanced absorption by edges and surface asperities on particles. However, a rigorous theoretical proof of this mechanism was lacking and the inferences of such a mechanism were based upon the comparisons of a heuristic theoretical treatment with experimental measurements on densely packed powers and roughened crystals. To show that the extra absorption by edges, postulated is solidly based in theory was attempted. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-20966 Stanford Univ., Calif.
BOUNDARY LAYER PHENOMENA IN COMBUSTION-DRIVEN MHD POWER GENERATORS Ph.D. Thesis
John Wallace Daily 1975 93 p
Avail: Univ. Microfilms Order No. 76-5718

An analytic and experimental study of boundary layer phenomena in combustion-driven MHD power generators has been conducted. Measurements of heat transfer rates and velocity, temperature, and electron number density profiles were compared with numerical calculations. The analysis is based on the two-dimensional boundary layer equations. The velocity, temperature, and electron number density profiles were measured at the downstream end of the channel. For the subsonic condition, high levels of free stream turbulence were measured, about 10-12%. The measured velocity profile was fatter than that predicted, although the temperature and electron number density profiles were in agreement. A correction to the turbulence model produces agreement between the measured and calculated profiles. For the supersonic condition, the measured velocity, temperature, and electron number density profiles fell under the predicted profiles. The discrepancy is ascribed to three dimensional recirculation effects. Dissert. Abstr.

N76-20967 Stevens Inst. of Tech., Hoboken, N.J.
THEORETICAL INVESTIGATIONS OF ABSOLUTE AND CONVECTIVE INSTABILITIES IN BEAM PLASMA SYSTEMS Ph.D. Thesis
Janardhan Manickam 1975 127 p
Avail: Univ. Microfilms Order No. 76-5030

The Cerenkov interaction of a mono-energetic electron beam with the upper branch plasma wave of a cylindrical, homogeneous, Maxwellian magnetoplasma was investigated in the linear and nonlinear regimes. From linear theory the appropriate dispersion relation was derived and solved numerically to obtain conditions for the existence of the absolute and convective instabilities. The instability is shown to be convective when the group velocity of the plasma wave is positive, and is absolute when the group velocity is negative and the beam density exceeds a threshold density. Expressions for this were derived from a simplified form of the dispersion relation valid in the weak beam limit. A computer simulation was used to study the nonlinear regime. When a single mode dominates the instability, beam trapping is shown to be the limiting mechanism for further growth. In the case of the absolute instability a second nonlinear limit is obtained, where long term temporal oscillations were observed.
Dissert. Abstr.

N76-20968 Stevens Inst. of Tech., Hoboken, N.J.
NONLINEAR DEVELOPMENT OF ABSOLUTE AND CONVECTIVE BEAM-PLASMA INSTABILITIES Ph.D. Thesis
Robert W. Jones 1975 128 p
Avail: Univ. Microfilms Order No. 76-5026

The beam-plasma instability was investigated in the limit of a weak, cold beam, under conditions where a single convective mode dominates the wave spectrum. Beam particle trapping accounts qualitatively for the saturation of the instability. This work shows that the addition of linear cyclotron damping to the trapping model makes this agreement quantitative and extends its validity to the absolute beam-plasma instability. Additional unstable modes do occur, however, and these play a significant role in the nonlinear development of the instability. The beam trapped in the fastest wave is still unstable to waves of sufficiently lower phase velocity. These additional modes continue to grow and increase the total energy present in waves, accompanied by an additional beam loss. Once grown large enough they untrap the beam from the first mode and it decays. Dissert. Abstr.

N76-20969*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS OF THE NASA LEWIS BUMPY-TORUS PLASMA GENERATED WITH POSITIVE APPLIED POTENTIALS
J. Reece Roth, Glenn A. Gerdin, and Richard W. Richardson Washington Mar. 1976 56 p refs
(NASA-TN-D-8114; E-8484) Avail: NTIS HC $4.50 CSCL 20I

Experimental observations were made during steady-state operation of a bumpy-torus plasma at input powers up to 150 kW in deuterium and helium gas and with positive potentials applied to the midplane electrodes. In this steady-state ion heating method a modified Penning discharge is operated such that the plasma is acted upon by a combination of strong electric and magnetic fields. Experimental investigation of a deuterium plasma revealed electron temperatures from 14 to 140 eV and ion kinetic temperatures from 160 to 1785 eV. At least two distinct modes of operation exist. Experimental data shows that the average ion residence time in the plasma is virtually independent of the magnetic field strength. Data was taken when all 12 anode rings were at high voltage, and in other symmetric configurations in which the toroidal plasma was generated by applying positive potentials to six anode rings, three anode rings, and a single anode ring. Author

N76-20970# Brookhaven National Lab., Upton, N.Y.
EXPERIMENTAL FACILITY FOR DETERMINING PLASMA CHARACTERISTICS IN ION SOURCES
M. A. Abroyan, Yu. M. Kagan, N. B. Kolokolov, and B. P. Lavrov 1974 29 p refs Transl. into ENGLISH from the Russian report

(BNL-TR-609; NIIEFA-D-0220) Avail: NTIS HC $4.50

A facility for optical and electrical measurements of the plasma parameters in the arc plasma ion sources is described. The potentialities of the system are demonstrated on the basis of the electron concentration, the electron energy distribution function, and the radial population distribution of the excited states of hydrogen atoms in the arc plasma of the duoplasmatron. Author (NSA)

N76-20971# Oak Ridge National Lab., Tenn.
SYNCHROTRON STUDY OF ESCAPING ELECTRONS IN TOKAMAK TM-3
V. S. Vlasenkov, M. M. Larionov, and V. V. Roshdestvenskii 1974 7 p refs Transl. into ENGLISH from the Russian report Rept-472 Sponsored by ERDA
(ORNL-TR-4000; NP-20330; Rept-472) Avail: NTIS HC $4.00

Measurements of the radiation plasma temperature in 4 and 8-mm wavelength bands on Tokamak TM-3 are described. Nonthermal radiation with temperatures approximately equal 10 keV was registered. Nonthermal radiation is supposed to be synchrotron radiation of run away electrons. Their properties were also considered. On the base of data obtained parameters of the run away electron flux were estimated. Author (NSA)

N76-20972# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands).
METHOD FOR MEASURING THE FIELD-INDEX IN A TOKAMAK
P. C. T. VanderLaan Apr. 1975 5 p refs
(NP-20575) Avail: ERDA Depository Libraries HC $4.00

A description is given of various types of coils with which the field-index of the vertical field in a Tokamak can be measured. Other applications of the described coils are: a measurement of the radius of curvature of a general vacuum field, a measurement of the derivative of the field along the field lines and a measurement of the field penetrating a hollow cylinder. Author (NSA)

N76-20973# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
STRONG TURBULENCE THEORY AND THE TRANSITION FROM LANDAU-TO COLLISIONAL DAMPING
C. T. Dum Jun. 1975 11 p refs
(IPP-6/136) Avail: ERDA Depository Libraries HC $4.00

Methods are introduced for a quantitative evaluation of the dielectric constant describing the interaction of a long wavelength test wave with electrons in the presence of electron-ion collisions or small scale turbulence. It is shown that the usual resonance broadening arguments of strong turbulence theory do not apply. Author (NSA)

N76-20974# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
MEASUREMENT OF THE DIFFRACTION CHARACTERISTIC FOR 2 mm WAVE RADIATORS OF ASDEX
B. Cannici, G. Lisitano, and P. Morandi Jun. 1975 14 p refs
(IPP-3/18) Avail: ERDA Depository Libraries HC $4.00

Beam refraction in a laser interferometer was studied. The experience gained with the Tokamak Pulsator is discussed and the measurements of the simulated refraction pattern for the proposed ASDEX radiators show that the measurement of the density distribution of ASDEX at a wavelength of 2 mm is possible. Author (NSA)

N76-20975# Princeton Univ., N.J. Plasma Physics Lab.
MEASUREMENT OF THE DEVELOPMENT AND EVOLUTION OF SHOCK WAVES IN A LASER-INDUCED GAS BREAKDOWN PLASMA
T. K. Chu and L. C. Johnson Dec. 1974 28 p refs
(Contract AT(11-1)-3073)
(MATT-1085) Avail: NTIS HC $4.50

Space- and time-resolved interferometric measurements of electron density in CO2-laser produced plasmas in helium or hydrogen are made near the laser focal spot. Immediately after breakdown, a rapidly growing region of approximately uniform plasma density appears at the focal spot. After a few tens of nanoseconds, shock waves are formed, propagating both transverse and parallel to the incident laser beam direction. Behind the transverse propagating shock is an on-axis density minimum, which results in laser-beam self trapping. The shock wave propagating toward the focusing lens effectively shields the interior plasma from the incident beam, because the lower plasma temperature and higher plasma density in the shock allow strong absorption of the incident beam energy. By arranging the laser radiation-plasma interaction to begin at a plasma-vacuum interface at the exit of a free-expansion jet, this backward propagating shock wave is eliminated, thus permitting efficient energy deposition in the plasma interior. Author (NSA)

N76-20976# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTATIONAL PLASMA PHYSICS
J. Killeen Aug. 1975 63 p refs Sponsored by ERDA
(UCRL-77211; Conf-750865-1) Avail: NTIS HC $6.25

The behavior of a plasma confined by a magnetic field is simulated by a variety of numerical models. Some models used on a short time scale give detailed knowledge of the plasma on a microscopic scale, while other models used on much longer time scales compute macroscopic properties of the plasma dynamics. The status of MHD, transport, equilibrium, stability, Vlasov, Fokker-Planck, and Hybrid codes is reviewed. These codes have already been essential in the design and understanding of low and high beta toroidal experiments and mirror systems. The design of the next generation of fusion test reactors will require continual development of these numerical models in order to include the best available plasma physics description and also to increase the geometric complexity of the model. Author (NSA)

N76-20977# Princeton Univ., N.J.
NUMERICAL STUDY OF THE MAGNETOHYDRODYNAMIC SPECTRA IN TOKAMAKS USING GALERKIN'S METHOD
R. L. Dewar, J. M. Greene, and R. C. Grimm Dec. 1974 43 p refs
(Contract AT(11-1)-3073)
(MATT-1099) Avail: NTIS HC $5.25

A computational technique is described for determining the ideal magnetohydrodynamic spectrum and its associated eigenfunctions. The method is suitable for axisymmetric toroidally confined plasmas with arbitrary cross sections. Using the special case of a long, straight, elliptical plasma column with low pressure and uniform axial current where analytic results are available, a study is made of the efficacy of two different choices of expansion functions. The use of a finite element representation, keeping only a small number of terms, is shown to provide a good description of the system. Author (NSA)

N76-20978# Princeton Univ., N.J. Plasma Physics Lab.
THEORY OF PLASMA SIMULATION USING THE MULTIPOLE-EXPANSION SCHEME
L. Chen Jan. 1975 28 p refs
(Contract AT(11-1)-3073)
(MATT-1093) Avail: NTIS HC $4.50

Nonphysical grid effects in plasma simulation using the multipole-expansion scheme and Gaussian-shape charge particles are studied analytically in one dimension. General expressions for the linear dispersion relation, fluctuation spectra, energy, and momentum conservations are derived and then compared with those of the cloud-in-cell (CIC) scheme. The results indicate that the dipole-expansion scheme and its subtracted version have, in general, grid effects comparable to CIC. Grid effects are, however, greatly reduced in schemes keeping higher order moments, such as the quadrupole-expansion scheme. Author (NSA)

N76-20979# Oak Ridge National Lab., Tenn.
NEUTRON EMISSION FROM ORMAK
L. A. Berry, A. C. England, J. F. Lyon, and G. L. Morgan Sep. 1975 30 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5054) Avail: NTIS HC $4.00

Neutron rates from deuterium beam injection into a deuterium plasma were studied in ORMAK. The absolute rates as well as the ratio of co- to counterinjection-produced neutrons are in agreement with a simple theory. This theory takes into

account the electric field and electron temperature but neglects loss regions, deuteron deficiency, trapping efficiencies, and energy diffusion. The neutron energies were measured with an organic scintillator. The 2.45-MeV group from the primary d-d reaction is evident and another group at approximately 1 MeV apparently from inelastic collisions in aluminum is observed. There is disagreement between the relative neutron rates and the expected rates of neutrons from the injection calculated on the basis of charge-exchange measurements. Further calculations are expected to resolve this discrepancy. Author (NSA)

N76-20980# Princeton Univ., N.J. Plasma Physics Lab.
THEORY AND NUMERICAL SIMULATION OF COLLECTIVE TRANSPORT OF PLASMA IN MAGNETIC FIELDS
J. Canosa, J. Krommes, C. Berman, H. Okuda, K. Tsang, J. M. Dawson, and T. Kamimura Oct. 1974 14 p refs
(Contract AT(11-1)-3073)
(MATT-1076; IAEA-CN-33/H2) Avail: NTIS HC $4.00

Numerical and theoretical studies were made on the transport of particles and heat in collisionless plasmas in magnetic fields for both quiescent and turbulent states. The following problems were investigated: (1) a systematic kinetic theory of hydrodynamic fluctuations in a strong magnetic field was developed to study the particle diffusion due to thermal convective cells, (2) effects of density and temperature gradients on thermal convective cells, (3) effects of mirroring magnetic field on convective diffusion, (4) turbulent electron heat transfer due to short wavelength ion fluctuations near the lower hybrid frequency, (5) heat transfer due to emission and absorption of electrostatic plasma waves, (6) particle diffusion in a toroidal magnetic field due to collisions (neo-classical diffusion) and due to collective effects. Neoclassical theory agrees well with the numerical results when the long wavelength collective modes are suppressed. Author (NSA)

N76-20981# Princeton Univ., N.J. Plasma Physics Lab.
ENERGY TRANSPORT ACROSS A MAGNETIC FIELD BY PLASMA WAVES
J. Canosa Nov. 1974 46 p refs
(Contract AT(11-1)-3073)
(MATT-1084) Avail: NTIS HC $5.50

Cross-field energy transport by electrostatic plasma waves was studied theoretically and numerically for a plasma near thermal equilibrium. Energy transfer by plasma waves is significant in a high temperature plasma where collisional transport is quite small. For strong magnetic fields (omega/sub c/greater than or equal to omega/sub p), the simulations verify the theoretical prediction that energy transport by plasma waves increases slowly with the magnetic field, and that in the limit of large field magnitudes wave transport dominates classical collisional transport. Furthermore, in a strong magnetic field the relaxation of the temperature by wave transport may result in an anisotropic velocity distribution. For weak fields (omega/sub p/greater than omega/sub c/), the simulation shows that collisional transport is more important than wave transport, also in agreement with the theory.
Author (NSA)

N76-20982# California Univ., Livermore. Lawrence Livermore Lab.
REFLECT: A PROGRAM TO INTEGRATE THE WAVE EQUATION THROUGH A PLANE STRATIFIED PLASMA
J. W. Greene 18 Apr. 1975 64 p refs
(Contract W-7405-eng-48)
(UCID-16803) Avail: NTIS HC $5.45

A program was developed to integrate the wave equation through a plane stratified plasma with a general density distribution. The reflection and transmission of a plane wave are computed as a function of the angle of incidence. The polarization of the electric vector is assumed to be perpendicular to the plane of incidence. The model for absorption by classical inverse bremsstrahlung avoids the improper extrapolation of underdense formulae that are singular at the plasma critical surface. Suprisingly good agreement with the geometric-optics analysis of a linear layer was found. The system of ordinary differential equations is integrated by the variable-step, variable-order Adams method. Parametric studies of the absorption are summarized, and some possibilities for further development of the code are discussed.
Author (NSA)

N76-20983# Princeton Univ., N.J. Plasma Physics Lab.
OPTIMIZATION OF FUSION POWER DENSITY IN THE TWO-ENERGY-COMPONENT TOKAMAK REACTOR
D. L. Jassby Oct. 1974 61 p refs Sponsored by ERDA
(MATT-1072) Avail: NTIS HC $6.25

The optimal plasma conditions for maximizing fusion power density P/sub f/ in a beam-driven D-T Tokamak reactor are considered. Author (NSA)

N76-20984# Princeton Univ., N.J. Plasma Physics Lab.
EXPERIMENTS ON THE ADIABATIC TOROIDAL COMPRESSOR
K. Bol, J. L. Cecchi, C. C. Daughney, F. DeMarco, R. A. Ellis, Jr., H. P. Eubank, H. P. Furth, H. Hsuan, E. Mazzucato, and R. R. Smith Dec. 1974 14 p refs
(Contract AT(11-1)-3073)
(MATT-1092; IAEA-CN-33/A4-2) Avail: NTIS HC $4.00

Magnetic compressional heating of a Tokamak discharge has been demonstrated successfully in the Adiabatic Toroidal Compressor (ATC). In addition to these investigations of compressional heating, other basic measurements have been made on ATC recently. These measurements are of interest because the ATC incorporates an air-core transformer and dispenses with the usual copper shell, two features likely to be found on future larger devices with smaller aspect ratios. The following topics are discussed: (1) characteristics of the uncompressed discharges in ATC, including the dependence of beta/sub p/ on discharge parameters, bolometric measurements of the energy balance, measurements of the concentration of impurities; (2) MHD behavior and attempts at stabilization of the m equals 2 kink-tearing mode. Author (NSA)

N76-20985# Max-Planck-Institut fuer Plasmaphysik, Garching (West Germany).
MODEL FOR LASER HEATING OF SOLID TARGETS
M. Salvat Jan. 1975 22 p refs In GERMAN
(IPP-4/56) Avail: ERDA Depository Libraries HC $4.25

Consideration is given to a one-dimensional model for laser heating solid pellets with the aid of high energy lasers. Expressions are derived for the state parameters, the shock-wave and erosion front velocities as function of the laser lightwave length.
Author (NSA)

N76-20986# Oak Ridge Y-12 Plant, Tenn.
CONTROL STRATEGY FOR PLASMA EQUILIBRIUM IN A TOKAMAK
R. V. Miskell Aug. 1975 75 p refs
(Contract W-7405-eng-26)
(Y-1988) Avail: NTIS HC $5.45

Dynamic control of the plasma position within the torus of a TOKAMAK fusion device is a significant factor in the development of nuclear fusion as an energy source. This investigation develops a state variable model of a TOKAMAK thermonuclear device, suitable for application of modern control theory techniques. Author (NSA)

N76-20987# Oak Ridge National Lab., Tenn.
CONFINEMENT AND NEUTRAL INJECTION EXPERIMENTS IN ORMAK; THE ORMAK GROUP
J. F. Lyon 1975 23 p Presented at 7th European Conf. on Controlled Fusion and Plasma Phys., Lausanne, Switz. 1 Sep. 1975 Sponsored by ERDA
(CONF-750905-19) Avail: NTIS HC $4.25

The ORMAK operating regime was extended to higher toroidal fields, discharge currents, and neutral injection power. Confinement studies have concentrated on anomalous electron transport through scaling studies at constant q and the effects of MHD instabilities (through soft X-ray fluctuations) and impurities [through Z/sub eff/(r) comparison]. Ion heating increases linearly with coinjection power and counterinjection heating efficiency increases with discharge current. Author (NSA)

N76-20988# Hanford Engineering Development Lab., Richland, Wash.
CONTROLLED THERMONUCLEAR RESEARCH Quarterly Report, Jan., Feb., Mar. 1975
D. G. Doran, comp. and H. H. Yoshikawa, comp. May 1975 55 p refs

(Contract AT(45-1)-2170)
(HEDL-TME-75-56) Avail: NTIS HC $5.45

The objective of this program is the correlation of irradiation effects produced in reactor and accelerator irradiation facilities for the prediction of materials performance in CTR environments. This includes the definition of the applicability of irradiation test data from other programs to the CTR effort and the implications of the differences between irradiation test environments and CTR environments to the design of CTR materials irradiation testing programs. Four interrelated tasks have been defined for this program: (1) correlation of damage data for CTR applications, (2) irradiation effects modeling in support of experimental programs, (3) damage production modeling in support of experimental programs, and (4) helium production file development. Author (NSA)

N76-20989# Illinois Univ., Urbana. Coordinated Science Lab.
DISCHARGE DYNAMICS OF THE ac PLASMA DISPLAY PANEL
Larry Francis Weber Aug. 1975 219 p refs
(Contracts DAAB07-72-C-0259; DAAC15-73-C-0077; F30603-73-C-0370; Grant NSF GJ-31765)
(AD-A017300; R-687; UILU-ENG-75-2222) Avail: NTIS CSCL 09/5

The ac plasma display panel is presently being sold by a number of large corporations and is satisfying a wide range of display applications. However most of its excellent characteristics have been achieved through empirical efforts. The thesis presents both theoretical and experimental results that begin to explain some of the detailed physical characteristics of this device. GRA

N76-20990# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
VACUUM-ARC SOURCE OF METALLIC IONS Final Report, 1 Jan. 1974 - 30 Jun. 1975
James W. Robinson and Mooyoung Ham Jun. 1975 18 p refs
(Grants NSF ENG-73-03782; NSF GK-41265)
(PB-247060/7; NSF/ENG-7303782-1) Avail: NTIS HC $3.50 CSCL 20I

Vacuum discharge systems developed for use as metallic ion sources are described. The pulses are formed by charging a capacitor to such a voltage that breakdown occurs between electrodes spaced less than 1 mm apart. Upon breakdown, the capacitor is discharged through the gap which then returns to a nonconducting state and the process is repeated. Ion production is measured for a variety of conditions. Also, the ionization states are identified. The systems differed in the way that the electrode gap was controlled through feedback and thus in the modes of stable operation which have been demonstrated. Erosion rates have been measured and potential applications of the erosion phenomenon are given. GRA

N76-20991# General Atomic Co., San Diego, Calif.
REPORT OF WORKSHOP ON PLASMA DYNAMICS AND THE NATION'S ENERGY OPPORTUNITIES Final Report
Tihiro Ohkawa, Abraham Hertzberg (Washington Univ.), and Park H. Miller 1 Oct. 1974 113 p refs Workshop held at La Jolla Shores, Calif.
(Grant NSF GP-44356)
(PB-246981/5) Avail: NTIS HC $5.50 CSCL 20I

The conclusions are summarized of a workshop held October 1-2, 1974, which was attended by a diverse group of both practitioners and users of plasma physics, and representatives of government agencies, to explore the needs of the various energy programs for plasma research. Recommendations are presented on: plasma theory and computation; low energy plasma research; university-level experimental research in support of fusion; role of NSF. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N76-20992 State Univ. of New York, Stony Brook.
CONTRIBUTIONS OF ANHARMONICITY AND ELECTRON-PHONON INTERACTION TO THE THERMODYNAMICS OF SOLIDS Ph.D. Thesis
John Chee Kuen Hui 1975 102 p
Avail: Univ. Microfilms Order No. 76-4862

Recent experimental results indicate that phonon frequencies and high temperature phonon specific heats of high transition temperature superconducting materials are T-dependent. This is due to the anharmonic and electron-phonon interaction effects. Low order perturbation theory and a self-consistent variational method are used to prove that the harmonic entropy expression for the phonon system is the only thermodynamic function with these two effects taken correctly by replacing the harmonic frequencies with the effective renormalized frequencies. The validity of this theorem is tested by a model calculation. The same entropy theorem is also proved for the electron system interacting with photons. Then it is shown that the correction to the phonon specific heat due to the T-dependent phonon frequency shifts from the e-p interaction is equal to the analogous correction to the electron specific heat from the T-dependent electronic energy shifts. Dissert. Abstr.

N76-20993 Stanford Univ., Calif.
THERMOMECHANICAL COUPLING EFFECTS IN THE DEFORMATION OF VISCOELASTIC SOLIDS Ph.D. Thesis
Richard Warren Young 1975 97 p
Avail: Univ. Microfilms Order No. 76-5832

The interaction between the mechanical deformation and the thermal state of solids is studied. Temperature changes arising from the isentropic deformation of elastic solids and the adiabatic deformation of viscoelastic solids are derived. It is found that the thermomechanical coupling effect is small in the nonoscillatory deformation of linear elastic, finite (rubber) elastic, and linear viscoelastic solids. The thermomechanical coupling effects are found to be important in oscillatory loadings of viscoelastic solids. Vibrations of a laterally insulated and unconstrained thermoviscoelastic rod are analyzed for a wide range of amplitudes and frequencies of driving displacement. Certain critical combinations of amplitude and frequency are found to lead to significant heating and softening of the rod. Maximum stress and temperature in the rod are presented as functions of the driving displacement. The relationship between stress and displacement boundary conditions is discussed. Dissert. Abstr.

N76-20994* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR MEASUREMENT OF TRAP DENSITY AND ENERGY DISTRIBUTION IN DIELECTRIC FILMS Patent
Joseph Maserjian, inventor (to NASA) (JPL) Issued 9 Mar. 1976 8 p Filed 11 Nov. 1974 Supersedes N75-11307 (13 - 02, p 0171) Sponsored by NASA
(NASA-Case-NPO-13443-1; US-Patent-3,943,442; US-Patent-Appl-SN-522551; US-Patent-Class-324-158R; US-Patent-Class-324-60C; US-Patent-Class-324-158D; US-Patent-Class-324-158T) Avail: US Patent Office CSCL 20L

Trap densities in dielectric films are determined by tunnel injection measurements when the film is incorporated in an insulated-gate field effect transistor. Under applied bias to the transistor gate, carriers (electrons or holes) tunnel into traps in the dielectric film. The resulting space charge tends to change channel conductance. By feeding back a signal from the source contact to the gate electrode, channel conductance is held constant, and by recording the gate voltage as a function of time, trap density can be determined as a function of distance from the dielectric-semiconductor interface. The process is repeated with the gate bias voltage at different levels in order to determine the energy distribution of traps as a function of distance from the interface.
Official Gazette of the U.S. Patent Office

N76-20995 Miami Univ., Fla.
TRANSMISSION RESONANCE IN FERROMAGNETIC GADOLINIUM Ph.D. Thesis
Owen H. Horan 1975 71 p

Avail: Univ. Microfilms Order No. 76-4702

A theoretical expression for the amplitude of a microwave magnetic field transmitted through a thin ferromagnetic Gd foil as a function of the dc magnetic field applied normal to the foil surface is derived. The effects of the exchange energy, Bloch-Bloembergen, and Landau damping terms are included. The boundary condition on the magnetization is discussed and the mixed form is used in the derivation of the signal expression. This expression is compared with experimental results using a nonlinear least squares curve fitting procedure to determine the saturation magnetization, relaxation time, skin depth, and exchange stiffness constant for 181 K., 259 K., and 273 K. The fittings indicate that the exchange term has negligible effect, that Landau damping is not applicable, and that Bloch damping is at least partially correct. Comparison between the fits for ferromagnetic Gd and paramagnetic Gd at 313 K. suggest there may be an additional damping process for ferromagnetic Gd.

Dissert. Abstr.

N76-20996+ Compagnie Generale d'Electricite, Marcoussis (France). Dept. d'Energie.

NIOBIUM-TITANIUM COMPOSITE MULTISTRAND WIRE STABILITY DURING INDUCTION VARIATIONS AS FOR CRYOALTERNATORS IN DEFAULT MODE Final Report [ETUDE DE LA STABILITE DE BRINS COMPOSITES MULTIFILAMENTAIRES A BASE DE NIOBIUM-TITANE SOUMIS AUX VARIATIONS D'INDUCTION QUI SE PRODUISENT DANS LE CAS DES CRYOALTERNATEURS EN REGIME DE DEFAUT]

Jean-Claude Renard Oct. 1974 28 p In FRENCH

(Contract DGRST-73-7-1453)

Avail: NTIS HC $4.00

The stability of multistrand wires based on NbTi under self field conditions is presented. Various structures were considered and correlations found between instabilities and strand characteristics leading to a degradation of the critical current. Theoretical investigations concerning a stability criterion were confirmed by experiments. It was shown that thermal exchanges play a leading role, and various modes were identified. ESA

N76-20997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CHANGES IN THE PERFORMANCE CHARACTERISTICS OF A GaAs NEAR INFRARED LIGHT EMITTING DIODE WHEN EXPOSED TO VARIOUS CURRENT AND THERMAL STRESSES

Edward F. Thomas, Jr. 19 Jun. 1974 43 p

(NASA-TM-X-72596; PACER-08-005) Avail: NTIS HC $4.00 CSCL 20L

The changes that occurred in the optical and electrical characteristics of a near infrared, GaAs light emitting diode, when operated under various levels and combinations of current and thermal stresses are discussed. A total of forty parts were operated for two thousand hours under eight different sets of dc current and ambient temperature conditions. Degradation in the radiant optical power of these devices was thirty-four percent when operated at their rated current and an ambient temperature of 298K (25 C). Derating the current and/or the thermal stress reduced the degradation of this parameter in approximately a linear manner. All degraded devices behaved similarly, exhibiting rapid nonlinear degradation followed by a gradual linear degradation and finally a period of stable operation. An attempt was made to correlate initial device condition to degradation during stress testing, but met with little success. Author

N76-20998*# Cornell Univ., Ithaca, N.Y. Atomic and Solid State Physics Lab.

A COMBINED REPRESENTATION METHOD FOR USE IN BAND STRUCTURE CALCULATIONS. 1: METHOD

Carlos Friedli and N. W. Ashcroft [1975] 18 p refs

(Grants NGR-33-010-188; NSF DMR-72-03029)

(NASA-CR-146771; TR-2634) Avail: NTIS HC $3.50 CSCL 20L

A representation was described whose basis levels combine the important physical aspects of a finite set of plane waves with those of a set of Bloch tight-binding levels. The chosen combination has a particularly simple dependence on the wave vector within the Brillouin Zone, and its use in reducing the standard one-electron band structure problem to the usual secular equation has the advantage that the lattice sums involved in the calculation of the matrix elements are actually independent of the wave vector. For systems with complicated crystal structures, for which the Korringa-Kohn-Rostoker (KKR), Augmented-Plane Wave (APW) and Orthogonalized-Plane Wave (OPW) methods are difficult to apply, the present method leads to results with satisfactory accuracy and convergence. Author

N76-20999# RAND Corp., Santa Monica, Calif.

THEORY OF NORMAL MODES AND ULTRASONIC SPECTRAL ANALYSIS OF THE SCATTERING OF WAVES IN SOLIDS

Yih-Hsing Pao (Cornell Univ., Ithaca, N. Y.) and C. C. Mow Dec. 1975 47 p refs

(R-1891-RC; MSC-2547) Avail: NTIS HC $4.00

A theory of the spectral analysis of the scattering of elastic waves is presented and illustrated with numerical results for the scattering by a circular cylindrical fluid inclusion in a solid. When the spectral frequencies are nearly equal to the real parts of the principal frequencies of the fluid inclusion in free vibration, the power spectrum of the scattered pulses undergoes a rapid rise and fall in magnitude because of the selective transmission of an incident wave. The conspicuous peaks and valleys of the backward and forward scattering spectra can be identified with the overtone frequencies of the two lowest normal models of the cylinder, from which the characteristics of the fluid inclusion, the ratio of the wave speed to radius, can be determined. An application of spectral analysis to quantitative nondestructive testing of materials is discussed. Author

N76-21000# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.

INTERNAL PLASMA DIAGNOSTIC WITH A MULTICHANNEL MAGNETIC PROBE SYSTEM USING AUTOMATIC DATA AQUISITION

M. Korten, P. G. Carolan, F. Sand, and F. Waelbroeck Apr. 1975 39 p refs

(JUL-1190) Avail: ERDA Depository Libraries HC $5.00

A 20-channel magnetic probe system inserted into the plasma was used to measure spatial distributions of poloidal and toroidal magnetic fields in the pulsed toroidal high beta experiment. Plasma parameters, e.g. the beta value, toroidal current density and radial pressure distribution were derived applying static equilibrium theory and can be calculated from the measurements. A data acquisition system used in conjunction with a process computer was operated to obtain the experimental data automatically and to perform the multiple computational tasks. The program system described was built to serve as a first stage of a more common software system applicable for computational data handling for different diagnostics of a plasma physics confinement experiment. Author (NSA)

N76-21001# Science Research Council, Chilton (England).

PRESSURE IMPREGNATED SUPERCONDUCTING DIPOLE

M. N. Wilson, R. B. Hopes, and R. L. Roberts 1975 9 p refs Presented at 5th Intern. Conf. on Magnet Technol., Frascati, Italy, 21-25 Apr. 1975

(RL-75-061; Conf-750438-6) Avail: ERDA Depository Libraries HC $4.00

A superconducting dipole is being constructed using a new high pressure impregnation technique. The windings will be enclosed in a strong pressure vessel and impregnated, at a pressure of about 35 MN/sq m with an epoxy resin which will subsequently be cured at that pressure. In this way it is hoped to reduce training, presuming this to be caused by conductor movement and resin fracture under the action of magnetic stress. No test results of the magnet are reported. Author (NSA)

N76-21002# Brookhaven National Lab., Upton, N.Y.

SUPERCONDUCTING MATERIALS FOR LARGE SCALE APPLICATIONS

D. Dew Hughes 1975 25 p refs Presented at Intern. Cryog. Mater. Conf. Kingston, Ontario, Can., 22 Jul. 1975 Sponsored by ERDA

(BNL-20403; Conf-750716-11) Avail: NTIS HC $4.25

Applications of superconductors capable of carrying large current densities in large-scale electrical devices are examined.

Discussions are included on critical current density, superconducting materials available, and future prospects for improved superconducting materials. NSA

N76-21003# Brookhaven National Lab., Upton, N.Y.
STABILITY OF A-15 COMPOUNDS IN MULTIFILAMENTARY SUPERCONDUCTING WIRES
T. Luhman, O. Horigami, and D. D. Hughes 1974 45 p refs Presented at the Symp. on Computer Networking and Chem., Chicago, 24 Aug. 1975 Sponsored by ERDA
(BNL-20471; Conf-750840-2) Avail: NTIS HC $5.25

The six systems Nb-Sn, Nb-Ga, Nb-Ge, Nb-Al, V-Si, and V-Ga were prepared as single-filament bronze wires and heat treated in an attempt to precipitate the appropriate A-15 compound. The compounds observed to form were categorized using a formation temperature ratio based on the melting temperatures of the constituents which make up the single filament composites. Several predictions regarding the formation of A-15 compounds are made using a solid-state bronze diffusion technique. Results of experimentation based on these predictions are presented. Author (NSA)

N76-21004# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
QUANTUM THEORETICAL STUDIES OF GAS-SOLID INTERACTIONS Final Report, 1 Sep. 1971 - 30 Jun. 1975
R. P. Messmer and C. W. Tucker Aug. 1975 64 p refs
(Contract F44620-72-C-0008; AF Proj. 9536)
(AD-A015833; SRD-75-086; AFOSR-75-1419TR) Avail: NTIS CSCL 07/4

In this final report, the authors summarize the results of their theoretical investigations into gas-solid interactions. In order to provide a proper perspective, they succinctly compare their approach to the more traditional solid state approaches to this problem. As previous reports have described our earlier work in some detail, they briefly review this prior work here. The main emphasis of this report is on theoretical gas-solid studies completed during the past year, which is previously unpublished. GRA

N76-21005# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
SOLID STATE PROPERTIES OF TRANSITION METAL COMPLEXES Final Scientific Report, 1 Sep. 1971 - 30 Jun. 1975
L. V. Interrante and J. S. Kasper Aug. 1975 66 p refs
(Contract F44620-71-C-0129; AF Proj. 9540)
(AD-A015834; SRD-75-085; AFOSR-75-1418TR) Avail: NTIS CSCL 07/2

The report describes the work on solid-state properties of transition metal complexes. Several different types of transition metal complex systems with anisotropic solid-state interactions have been prepared and studied using electrical conductivity, magnetic susceptibility, and spectral measurement methods. The results of these measurements and accompanying X-ray structural studies have been used to derive structure-property relationships and to obtain information regarding the nature of the intermolecular interactions occurring in the solid state. GRA

N76-21006# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va. Materials Engineering Div.
PERSISTENT CURRENTS IN SODIUM CHOLATE Progress Report
Solomon Goldfein Sep. 1975 14 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A016124; USAMERDC-01901-24-PMMR) Avail: NTIS CSCL 20/12

The object of this work was to obtain experimental evidence that sodium cholate had superconducting properties. It was tested by means of a superconducting susceptometer which is described as a thin film superconducting magnetometer (SQUID). The material was tested and found capable of carrying an indefinitely persistent current over macroscopic distances at temperatures ranging from 4-30K. The magnetic susceptibility was measured from 24-36K at 0.5K intervals and a discontinuity was found between 28 and 30K with a peak at 29K. The material is however, a bulk insulator. When this evidence is considered in the light of similar findings by tests performed by the Schawlow and Devlin frequency change method relationships previously found for (T sub c) vs e/a, (T sub c) vs 1/the square root of M (the isotope effect), (T sub c) vs (theta sub d), and the discontinuity found at 30K on a (c sub p) vs T curve the evidence for presence of superconductivity is very strong. The high resistence could possibly be attributed to a low concentration of conduction electrons coupled with an off center position of the sodium ion when considered in relation to the GL sandwich theory. GRA

N76-21007# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Guidance and Control Directorate.
RELATIONSHIPS BETWEEN THE DIELECTRIC CONSTANT, REFRACTIVE INDEX AND HYSTERESIS IN CRYSTAL STRUCTURES
J. E. Brown 18 Jul. 1975 26 p refs
(AD-A016873; RG-74-18) Avail: NTIS CSCL 20/2

This report describes the relationships of the dielectric constant and refractive index in crystal structures. It is an attempt, using existing literature, to investigate through conventional means, possible measurement and use of the speed of light in crystal structures. The attempt is made to establish the possibility of measuring crystal characteristics by applying an electric field and measuring the effect on light transmission. This appears possible because of the hysteresis effects that exist in crystal type structures. Author (GRA)

N76-21008# Army Electronics Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.
MAGNETIC PROPERTIES OF SINGLE CRYSTAL CuNi-18H AND MgZn-18H SOLID SOLUTIONS
R. O. Savage, A. Tauber, and J. R. Shappirio Nov. 1975 9 p refs
(DA Proj. 1T1-61102-B-31A)
(AD-A016918; ECOM-4363) Avail: NTIS CSCL 20/12

Hexagonal ferrites have been under investigation at this laboratory for several years as both potential narrow and broad ferrimagnetic resonance linewidth materials for several device applications at microwave and millimeter wave frequencies. Recently a new 18-layer structure $Ba5Me2Ti3Fe12O31$ where Me = Zn, Mg, Co, and Cu was discovered and several compositions have been investigated. In this paper the magnetic properties of two solid solutions MgZn-18H and CuNi-18H have been investigated as a function of temperature. The CuNi system is of interest for two reasons: Attempts to obtain end member Ni containing crystals have been unsuccessful and Ni containing hexagonal ferrites exhibit small temperature coefficients of magnetization. The latter is an important property for device applications. The second reason relates to the influence of Cu(2+) ions in creating uniaxial anisotropy. GRA

N76-21009# Defence Research Establishment Ottawa (Ontario).
ELECTRON SPIN RESONANCE STUDY OF MOLYBDENUM TRIOXIDE DOPED MANGANESE DIOXIDES
C. L. Gardner Oct. 1975 21 p refs
(AD-A017295; DREO-TN-75-24) Avail: NTIS CSCL 07/4

The structure and solid state properties of manganese dioxides are of interest because of the use of this oxide as a depolarizer in a variety of battery systems. Electron spin resonance spectroscopy (ESR) has been used to study a series of molybdenum oxide doped manganese dioxides. The ESR results show that both the surface area of the manganese dioxide as well as the Mn(2+) concentration in the material depends on the amount of molybdenum oxide added. Determination of these quantities is of interest since the work of Valand indicates that they are related to the electrochemical characteristics of the manganese dioxides. GRA

N76-21010# California Univ., Los Angeles. School of Engineering and Applied Science.
ANISOTROPIC TRANSPORT EFFECTS IN IGFETS Annual Report
James W. Holm-Kennedy Jul. 1975 10 p refs
(Contract N00014-69-A-0200-4054; NR Proj. 322-044)
(AD-A017450; UCLA-ENG-7568; AR-1) Avail: NTIS CSCL 20/12

The project deals with investigations into charge transport

and subbanding in semiconductor FET systems. It has been observed that the transport anisotropy diminishes with decreasing MOSFET inversion density. This is interpreted as a washing-out of the subband structure by the channel width modulating effects of the trapped surface charge. GRA

N76-21011# Intelcom Rad Tech, San Diego, Calif.
TRANSIENT RADIATION EFFECTS Final Report, Jun. 1973 - Jan. 1975
Terry M. Flanagan, Arne H. Kalma, Roland E. Leadon, James A. Naber, and Donald P. Snowden Mar. 1975 110 p refs
(Contract DAAG39-73-C-0197; DNA Proj. NWED-QAXTA008; HDL Proj. 335535)
(AD-A017022; INTEL-RT-8008-007; HDL-CR-75-197-1) Avail: NTIS CSCL 20/12

Studies are presented of the effects of the interaction of radiation with matter. Displacement damage in compound semiconductors is considered, with emphasis on GaAs. The temperature dependence of electron damage is determined, as well as the relative damage as a function of electron and neutron energy. Transient conductivity measurements on GaAs have been able to detect carrier lifetime at 300K in the nanosecond range. The response of AlSiO2Si (n-type) MOS devices to pulsed 30-MeV electron irradiations has led to the identification of a new charge-transfer effect. Models are presented of this effect and of gate threshold shifts for clean oxides and aluminum ion-implanted clean oxides using the PN code. Also presented is a study of the dependence of the charge released to an external circuit by a capacitor subsequent to burn-in through both thermal and radiation-induced depolarization of the space-charge fields. GRA

N76-21148 Tubingen Univ. (West Germany).
QUANTITATIVE MEASUREMENTS OF SHOCK LOADED MINERALS
J. Arndt, U. Hornemann (Arbeitsgruppe fuer Ballistische Forsch.), W. F. Mueller (Frankfurt Univ.), H. Schneider (Karlsruhe Univ.), and D. Stoeffler (Muenster Univ.) *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 251-273 refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft (For availability see N76-21129 11-99)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N76-21012# Bartlesville Energy Research Center, Okla.
THERMODYNAMIC PROPERTIES OF ORGANIC COMPOUNDS AND THERMODYNAMIC PROPERTIES OF FLUIDS Final Report, 1 Jul. 1974 - 30 Jun. 1975
Donald R. Douslin, William D. Good, Samuels Todd, Isham A. Mossenlopp, and Ann G. Osborn 30 Jun. 1975 18 p refs
(AF Proj. 9750)
(AD-A016090; AFOSR-75-1364TR) Avail: NTIS CSCL 07/4

In search for molecular structures that contain higher energies than normal jet fuel liquids, nine compounds were measured by combustion calorimetry to obtain their enthalpies of combustion in the liquid state at 25C. These results show 6.0 to 24.4 percent higher heats per unit volume than a better-than-average hydrocarbon jet fuel. New measurements on the vapor heat capacity, enthalpy of vaporization, and vapor pressure of 1,3-epoxypropane (trimethylene oxide) complete a comprehensive experimental thermodynamic investigation of a small ring molecule that has high ring strain energy. GRA

N76-21013# Iowa State Univ. of Science and Technology, Ames.
RESEARCH WORKSHOP ON AUGMENTATION OF CONVECTIVE HEAT TRANSFER Final Report
A. E. Bergles Apr. 1975 56 p refs Workshop held at Schiller Park, Ill., 22-23 Apr. 1974
(Grant NSF GK-42265)
(PB-246385/9; ISU-ERI-AMES-76026; HTL-8) Avail: NTIS HC $4.50 CSCL 20M

A workshop is summarized on heat transfer augmentation sponsored by the Energy-Related General Research Office of the National Science Foundation. The workshop, held at Schiller Park, Illinois on April 22, 23, 1974, was attended by 38 researchers from industry, universities, and government laboratories. The program was arranged so that up-to-date technical information on available augmentation techniques was discussed first. A second portion of the workshop was devoted to applications, involving both encouragement and accommodation of high heat fluxes; this helped participants focus on the needs of industry. Finally, with the information available from these sessions, an attempt was made to outline areas of augmentation research that are potentially fruitful scientifically and which could contribute significantly to the advancement of industrial technology. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N76-21014# Naval Underwater Systems Center, Newport, R.I.
NUMERICAL METHODS FOR ANALYZING WORLD DYNAMICS MODELS
Stanley A. Erickson and Ronald A. Pikul 9 Sep. 1975 63 p refs
(AD-A017068; NUSC-TR-4674) Avail: NTIS CSCL 05/11

This report is an extensive investigation of WORLD 2, the mathematical model used to forecast changes in the world's socio-economic system proposed by J. Forrester in 1971. Its purpose is to develop methods and techniques by which a rapid, facile study of other, more complicated models can be made. The significance of WORLD 2 major assumptions relative to its output are studied by devising and applying various computer techniques to the basic model and several variations of it. Standard small-scale sensitivity tests, reverse running, and scaling (inverse sensitivity tests) were among the techniques used to determine the extent of alteration necessary to produce in WORLD 2--without any structural modification--outcomes divergent from Forrester's calculations, thereby making possible identification of significant variables and sectors. GRA

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-21015# Dikewood Corp., Albuquerque, N.Mex.
CONTRACT WORK BREAKDOWN STRUCTURE FOR TESPO MANAGEMENT Final Report
June G. Brenton and Robert L. Stohler Oct. 1975 20 p refs
(Contract F29601-74-C-0022)
(AD-A017595; DC-TR-1242-3; AFSWC-TR-75-7) Avail: NTIS CSCL 05/1

Work Breakdown Structure (WBS) consists of a family-tree type subdivision of data, equipment, software, service, and other work activity to achieve a desired goal or produce an end product. This report presents representative schedules of contract WBSs for the Test and Evaluation Systems Program Office (TESPO) to use in management of many activities concerned with improving test and evaluation capabilities and providing a continental operations range (COR). GRA

N76-21016# RAND Corp., Santa Monica, Calif.
METHODOLOGY FOR SUBJECTIVE ASSESSMENT OF TECHNOLOGICAL ADVANCEMENT WITH APPENDIX
S. James Press, Alvin J. Harman, and Marc Nerlove Apr. 1975 112 p refs
(AD-A017522; R-1375) Avail: NTIS CSCL 05/1

This report presents techniques and approaches for assessing the feasibility of new systems or projects. Ways of generating information that will help to better articulate R and D options, and ways of developing analytical tools for refining the comparison among options are discussed. Described are ways that technical and economic expertise can be used for: assessing technological advances and trends, using quantitative techniques; comparing technological advances for various projects; and determining how technological advances affect R and D costs. GRA

N76-21017# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
THE IDENTIFICATION OF A PRECEDENCE NETWORK ASSOCIATED WITH BASE LEVEL AIRCRAFT MAINTENANCE M.S. Thesis
Clark D. Hubbard and Charles R. Lindke Aug. 1975 157 p refs
(AD-A016389; SLSR-12-75B) Avail: NTIS CSCL 15/5

The objective of this study was to develop a method of identifying precedence networks associated with aircraft maintenance that is more efficient than totally relying on the memory and experience of mechanics in the field. A precedence network is the sequence in which tasks should be performed because of their interdependencies. An example of this type of dependency would be the necessity to repair a fuel cell before refueling an aircraft. This research involved the use of the Logistic Composite Model (L-COM) developed by Headquarters, Air Force Logistics Command and the Rand Corporation, the F-4E data base which had been constructed as part of Headquarters, Tactical Air Command's L-COM Study, and Maintenance Data Collection System records for F-4E aircraft. GRA

N76-21018# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEVELOPMENT OF POSSIBLE GUIDELINES TO ASSIST USAF OPERATIVE EMPLOYEES TRANSITIONING IN FIRST-TIME SUPERVISORY POSITIONS M.S. Thesis
Robert J. Sallee Sep. 1975 244 p refs
(AD-A017221; GSM/SM/75S-9) Avail: NTIS CSCL 05/9

Air Force personnel making the transition from operative workers to supervisors for the first time need assistance in acquiring fundamentals of supervision which can be applied on the job. This thesis develops and presents a set of representative guidelines to help satisfy this need. Supervisory training programs of industry and the Air Force are reviewed to determine the attitudes, knowledge, and skills required by the first-time supervisor. Materials within these programs appropriate to the Air Force supervisor are collected and organized into a sample self-help handbook which could be used by the first-time supervisor. GRA

N76-21019# University of Southern Calif., Los Angeles. Social Science Research Inst.
RESEARCH ON THE TECHNOLOGY OF INFERENCE AND DECISION Final Technical Report, 1 Dec. 1974 - 30 Jun. 1975
Ward Edwards 31 Aug. 1975 27 p refs
(Contract N00014-75-C-0487; ARPA Order 2105; NR Proj. 197-021)
(AD-A017525; USC-001597-F; SSRI-RR-75-10) Avail: NTIS CSCL 05/10

The research conducted under this program falls under three major themes--each falling within a primary division of decision analysis; the two types of inputs, probabilities and utilities, and the combination of the inputs. Both theoretical and experimental work is included with much of the impetus coming from problems found in practical applications of technologies for aiding decision making. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-21020*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FY 1974 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
Oct. 1974 93 p refs
(NASA-TM-X-73045; AS61-74-01) Avail: NTIS HC$5.00 CSCL 05B

Formal NASA technical reports and papers published in technical journals, and presentations by MSFC personnel during FY 1974 are presented. Papers from MSFC contractors are also included. Author

N76-21021# Department of Housing and Urban Development, Washington, D.C. Library Div.
URBAN VOCABULARY
1975 103 p
(PB-246211/7) Avail: NTIS HC $5.50 CSCL 05B

The report is a revised edition of the 1971 Urban Vocabulary, which in turn was a revision of Subject Headings Used in the Catalog of the HHFA Library published in 1962 by the Housing and Home Finance Agency Library. Urban Vocabulary consists of two parts. (1) Part A: Urban vocabulary with corresponding classification numbers, (2) Part B: Classification schedule, consisting of an arrangement by classification number, with corresponding subject. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N76-21022# Army Aviation Systems Command, St. Louis, Mo. Office of the Comptroller.
SOURCES AND NATURE OF COST ANALYSIS DATA BASE REFERENCE MANUAL Interim Report
Ralph W. Lilge Sep. 1975 108 p refs
(AD-A016116; USAAVSCOM-TR-75-37) Avail: NTIS CSCL 15/5

Citing specific examples, the report examines, evaluates, analyzes, and portrays the sources and nature of the cost analysis data base emphasizing important interrelationships between process (gathering, normalization, evaluation), professional skill requirements, the planning of future report revisions, and the development of new data sources. For analysis, the main body of the report employs an expanded 13-step format. Entries on the format were obtained from personal interviews. The report is organized to permit future changes and to facilitate cross-referencing. GRA

N76-21023# National Research Council of Canada, Ottawa (Ontario).
PROBLEMS OF THE NORTH, NUMBER 16, 1972
Jun. 1975 424 p Transl. into ENGLISH from Problemy Severa (USSR), no. 16, 1972 p 3-254
(AD-A017017) Avail: NTIS CSCL 05/3

A partial listing of topic areas includes: Basic aspects of increasing efficiency of resource allocation in the North of the U.S.S.R.; Building in the North; Cost structure and evaluation of engineering solutions in the North; Some ways of reducing the cost of developing new machinery for the North; Ways of developing local food production and exploitation of biological resources in the North; Increasing the efficiency of production in the European North of the U.S.S.R.; The economic efficiency of the oil and gas industry of the Komi U.S.S.R.; Integrated development of building materials production and the construc-

tion industry in the European North; Comparative efficiency of thermal and atomic power generation in the Northeast; Role of ferrous metallurgy in the development of the resources of the far-eastern North; Methods of economic development and construction in the Canadian North; Problems and new concepts of mid-Canada development; The oil industry of Alaska; Improving the cross-country performance of vehicles under Arctic conditions. GRA

N76-21024# General Dynamics/Convair, San Diego, Calif.
WEAPON SYSTEM COSTING METHODOLOGY FOR AIRCRAFT AIRFRAMES AND BASIC STRUCTURES. VOLUME 2: ESTIMATING HANDBOOK AND USER'S MANUAL, PART 1 Final Report, Jul. 1972 - Feb. 1975
R. E. Kenyon May 1975 184 p
(Contract F33615-72-C-2083; AF Proj. 1368)
(AD-A016409; AFFDL-TR-75-44-Vol-2-Pt-1) Avail: NTIS CSCL 01/3

This volume provides a detailed description of the function and use of two weapon system costing methodologies for aircraft airframes and basic structures developed for the Air Force Flight Dynamics Laboratory for use in conceptual and preliminary designs phases of weapon system development. The methods are a trade study costing method for detailed cost analysis of trades-off between weight, cost, type of construction and type of material and a system costing method for determining the projected cost of a complete airframe within the context of a weapon system development. This volume describes how to make an estimate using either technique and shows the results of a demonstration case. Tradeoff capability has been provided for a range of alternative structure and material combinations. A technique for independent assessing complexity factor has been developed and demonstrated. Manufacturing costs are separately estimated for the primary elements of substructure: ribs, spars, covers, leading edges, trailing edges, tips, etc. The trade study method provides an iterative capability stemming from a direct interface with design synthesis programs. A detailed cost data base and system for data expansion are provided. The methods are designed for ease in changing cost estimating relationships and estimating coefficients resulting from cost data update. Author (GRA)

N76-21025# Aerospace Guidance and Metrology Center, Newark Air Force Station, Ohio.
AVIONICS PROLIFERATION, A LIFE CYCLE COST PERSPECTIVE Final Report
Russell M. Genet and Thomas D. Meitzler 30 Jul. 1975 30 p
(AD-A016478; AGMC-75-002) Avail: NTIS CSCL 01/3

The paper discusses proliferation and when it can occur. It specifically looks at the economic question of when can it be cost effective to use an existing military inertial navigation system for new aircraft rather than developing and using a new system. The discussion is from a life cycle cost viewpoint with particular attention to the 'start-up' costs. Attached with the paper is a complete reproduction of the input data and computer results used. GRA

N76-21026# National Bureau of Economic Research, Inc., Cambridge, Mass. Computer Research Center for Economics and Management Science.
CONFERENCE ON MODELING LARGE-SCALE SYSTEMS AND RELATED SOFTWARE
Edwin Kuh 17 Jun. 1975 26 p Conf. held at Vail, Colorado, 16-17 Jun. 1975
(Grant NSF DCR-75-16390)
(PB-246301/6) Avail: NTIS HC $4.00 CSCL 05C

Recommendations of the conference were grouped under the following four headings: (1) software development and accessibility, (2) algorithms, (3) large-scale models, and (4) estimation. The rest of the report consists of the proceedings of the two day conference with summaries of the papers presented by the conference participants. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N76-21027# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT; SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS BILL, 1975
Proxmire Washington GPO 1974 55 p Rept. to accompany H.R. 15572, 93d Congr., 2d Sess., 15 Aug. 1974
(S-Rept-93-1091; GPO-38-010) Avail: U.S. Capitol, Senate Document Room

The appropriations bill for the Department of Housing and Urban Development, the National Aeronautical and Space Administration, the National Science Foundation, the Veterans Administration, and eight other independent agencies is reported. The amounts recommended in the bill are summarized and compared with the appropriations for FY 1974, the budget estimate for 1975, and the amount contained in the House bill. J.M.S.

N76-21028*# Kanner (Leo) Associates, Redwood City, Calif.
EDUCATION AND RESEARCH IN THE FIELD OF EUROPEAN LAW
M. Bourely Mar. 1976 11 p Transl. into ENGLISH from the French report Presented at the European Conf. of Deans of Law Schools, Strasbourg, 20-23 Nov. 1968
(Contract NASw-2790)
(NASA-TT-F-16914) Avail: NTIS HC $3.50 CSCL 05D

The nature of the regulations set up by the European space vehicle launcher development organization and their relationship to, and possible repercussions on, European law are described. An exchange of information and technical aid between ELDO and European law schools is proposed, with ELDO furnishing information on its regulations and activities, and the law schools providing background information on comparative law and other general legal matters. Author

N76-21029# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1977
Moss Washington GPO 30 Mar. 1976 57 p Rept. on H.R. 12453 of Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 30 Mar. 1976
(S-Rept-94-718; GPO-57-010) Avail: U.S. Capitol, Senate Document Room

The bill to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program management is reported. Appropriations for FY 1977 are summarized in the following areas: space shuttle; space flight operations; expendable launch vehicles; physics and astronomy; lunar and planetary exploration; life sciences; space applications; earth resources operational systems; aeronautical research and technology; tracking and data acquisition; and technology utilization. J.M.S.

N76-21030# Committee on Aeronautical and Space Sciences (U. S. Senate).
TO AUTHORIZE APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION FOR RESEARCH AND DEVELOPMENT, AND PROGRAM MANAGEMENT, AND FOR OTHER PURPOSES
Washington GPO 23 Mar. 1976 15 p H.R. 12453 referred to the Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 23 Mar. 1976
Avail: US Capitol, Senate Document Room

A bill authorizing appropriations to NASA by Congress is introduced. The appropriations were authorized for research and development, facility construction, research and program management, and various other activities-salaries, retirement, and other employee benefits as authorized by law. E.H.W.

N76-21031# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1974. PART 2: DEPARTMENT OF THE ARMY
Washington GPO 1974 1165 p refs Hearings before a subcomm. of the Comm. on Appropriations, 93d Congr., 1st Sess., 29 Mar. 1973
(GPO-96-412) Avail: Comm. on Appropriations

The Department of Defense budget request for FY 1974 for the Army and Navy is discussed. Factors considered include:

readiness and modernization of weapons systems; improvement of military life; drug problems; conditions of barracks; operation and maintenance; procurement appropriations; research, development, and testing; construction; reserve components; family housing; and site defense. Appropriations for FY 1972, 1973, and 1974 are summarized and compared. J.M.S.

N76-21032# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1974. PART 3: DEPARTMENT OF THE NAVY
Washington GPO 1974 1456 p refs Hearings before a subcomm. of the Comm. on Appropriations, 93d Congr., 1st Sess., 30 Mar. 1973
(GPO-96-547) Avail: Comm. on Appropriations
For abstract, see N76-21031.

N76-21033# Select Committee on Small Business (U. S. House).
ENERGY DATA REQUIREMENTS OF THE FEDERAL GOVERNMENT: PART 3: FEDERAL OFFSHORE OIL AND GAS LEASING POLICIES
Washington GPO 1974 582 p refs Hearings before Subcomm. on Activities of Regulatory Agencies of the Permanent Select Comm. on Small Business, 93d Congr., 2d Sess., 26-27 Mar.; 9-11 Apr. and 7 May 1974
(GPO-35-032) Avail: Subcomm. on Activities of Regulatory Agencies

Hearings made before the subcommittee on activities of regulatory agencies of the permanent select committee on small business of the U.S. House of Representatives during March, April, and May 1974 were reported. The subjects discussed included: producible shut-in leases, gas supply and reserve estimates, continental shelf lease management, royalty and bonus bidding. Y.J.A.

N76-21034# Committee on Appropriations (U. S. Senate).
SPECIAL ENERGY RESEARCH AND DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 1975
Washington GPO 1974 890 p refs Hearings on H.R. 14434 before Comm. on Appropriations, 93d Congr., 2d Sess., 4 Mar. 1974
(GPO-32-023) Avail: Comm. on Appropriations

Hearings held before the committee on appropriations of the United States Senate concerning appropriations for energy research and development activities of certain departments, independent executive agencies, bureaus, offices, and commissions for FY 1975 were reported. Y.J.A.

N76-21035# European Space Agency, Paris (France).
THE LEGAL FRAMEWORK OF EUROPEAN COOPERATION IN THE EXECUTION OF SPACE APPLICATION PROGRAMS
M. Boureley 1975 15 p Presented at the 18th Colloq. of Intern. Inst. of Space Law, Lisbon, 23-27 Sep. 1975
Avail: NTIS HC $3.50

The legal framework within which the European Space Agency's space application programs can be executed on a joint basis is outlined. The relevant institutional factors are mentioned, and the legal rules presently applicable to the application program already under way are described and compared with those that will apply when the new convention enters into force. ESA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-21036*# George Washington Univ., Washington, D.C.
PROGRAM OF POLICY STUDIES IN SCIENCE AND TECHNOLOGY: READINGS IN TECHNOLOGY ASSESSMENT
Sep. 1975 742 p refs
(Grant NGL-09-010-030)
(NASA-CR-146555) Avail: NTIS HC $18.75 CSCL 05A

Articles are presented concerning the historical, theoretical, methodological, and institutional aspects of technology assessment. For individual titles, see N76-21037 through N76-21040.

N76-21037* George Washington Univ., Washington, D.C.
DEVELOPMENT OF THE CONCEPT OF TECHNOLOGY ASSESSMENT
In its Program of Policy Studies in Sci. and Technol.: Readings in Technol. Assessment Sep. 1975 184 p refs (For availability see N76-21036 11-85)
CSCL 05A

The historical, public policy, and social impact of technology assessment are discussed along with the proposal to the National Science Foundation for retrospective technical assessment. F.O.S.

N76-21038* George Washington Univ., Washington, D.C.
INSTITUTIONALIZATION OF TECHNOLOGY ASSESSMENT
In its Program of Policy Studies in Sci. and Technol.: Readings in Technol. Assessment Sep. 1975 244 p refs (For availability see N76-21036 11-85)
CSCL 05A

The operational implications of a congressional assessment component are examined by means of a hypothetical structure. Legal and jurisdictional implications, and public policy are discussed. F.O.S.

N76-21039* George Washington Univ., Washington, D.C.
THE INTERFACE BETWEEN TECHNOLOGY ASSESSMENT AND THE LAW
In its Program of Policy Studies in Sci. and Technol.: Readings in Technol. Assessment Sep. 1975 89 p refs (For availability see N76-21036 11-85)
CSCL 05A

The adversarial system, advocacy, and the law's interface with technology assessment are discussed. F.O.S.

N76-21040* George Washington Univ., Washington, D.C.
CASE STUDIES
In its Program of Policy Studies in Sci. and Technol.: Readings in Technol. Assessment Sep. 1975 217 p refs (For availability see N76-21036 11-85)
CSCL 05A

The characteristics of the technology assessment process which were manifested in response to the hazardous effects of early medical uses of X-rays are considered. Other topics discussed include: controlling the potential hazards of government-sponsored technology, genetic technology, community level impacts of expanded underground coal mining, and an integrated strategy for aircraft/airport noise abatement. F.O.S.

N76-21041*# Mathematica, Inc., Princeton, N.J.
QUANTIFYING THE BENEFITS TO THE NATIONAL ECONOMY FROM SECONDARY APPLICATIONS OF NASA TECHNOLOGY
Washington NASA Mar. 1976 182 p refs
(Contract NASw-2734)
(NASA-CR-2673) Avail: NTIS HC $7.50 CSCL 05A

The feasibility of systematically quantifying the economic benefits of secondary applications of NASA related R and D is investigated. Based upon the tools of economic theory and econometric analysis, it develops a set of empirical methods and makes selected applications to demonstrate their workability. Analyses of the technological developments related to integrated circuits, cryogenic insulation, gas turbines, and computer programs for structural analysis indicated substantial secondary benefits accruing from NASA's R and D in these areas. Author

N76-21042# Stanford Research Inst., Menlo Park, Calif.
CHOOSING TECHNOLOGICAL OPPORTUNITIES FOR INNOVATION IN THE PUBLIC SECTOR. VOLUME 1: BASIC REPORT AND SUMMARY Final Report
Charles W. Williams Mar. 1975 196 p refs
(Contract NSF C-846)

(PB-247075/5; NSF/RA/R-75-001A-Vol-1) Avail: NTIS HC $7.50 HC also avail. for $21.00/set of 3 reports as PB-247074-SET CSCL 05A

This study was undertaken in support of the continuing effort to stimulate technological innovations that will contribute to improving the delivery or performance of public services at the state and local levels of government. The specific purposes were: (1) further development and testing of methodologies for better relating technologies to needs; (2) formulation of better techniques for identification of technological opportunities; (3) establishing more utilitarian methods of barrier analysis, and (4) selection of a small number of innovational opportunities which seem worthy of more detailed priority analysis and support. The plan employed market research, an independent inventory of technological capabilities, and a listing of selection criteria based upon perceived needs. GRA

N76-21043# Stanford Research Inst., Menlo Park, Calif.
CHOOSING TECHNOLOGICAL OPPORTUNITIES FOR INNOVATION IN THE PUBLIC SECTOR. VOLUME 2: INVENTORY OF PUBLIC SERVICES AND TECHNOLOGY Final Report
Charles W. Williams, Peter Schwartz, and Douglas Seymour Mar. 1975 267 p
(Contract NSF C-846)
(PB-247076/3; NSF/RA/R-75-001B-Vol-2) Avail: NTIS HC $9.00 HC also avail. for $21.00/set of 3 reports as PB-247074-SET CSCL 05A

Detailed descriptive data are presented concerning the four geographic areas investigated: (1) a central city surrounded by suburban communities that are independent entities--Cincinnati, Ohio. (2) A suburban county that sits as an integral part of a large metropolitan area--DuPage County, Illinois (Chicago area). (3) A small urban center surrounded by rural regions--Albany, Georgia. (4) A rural county not near an urban area--Clay County, North Carolina. The following outputs are covered: communications, police services, fire protection, water works, sewers, solid waste collection and disposal, highway and street construction and maintenance, public transportation, public health service, and education. GRA

N76-21044# Stanford Research Inst., Menlo Park, Calif.
CHOOSING TECHNOLOGICAL OPPORTUNITIES FOR INNOVATION IN THE PUBLIC SECTOR. VOLUME 3: TWELVE TECHNOLOGICAL CASE STUDIES Final Report
Charles W. Williams, Peter Schwartz, and Jack Tarpey Mar. 1975 155 p
(Contract NSF C-846)
(PB-247077/1; NSF/RA/R-75-001C-Vol-3) Avail: NTIS HC $6.75 HC also avail. for $21.00/set of 3 reports as PB-247074-SET CSCL 05A

Reports are presented of the technological case studies of the 12 candidate innovations selected for further investigation. These reports represent the results of the application of the barrier analysis format previously described. Reference is also made to the applicability of several specific concepts discussed in the basic report, such as aggregate operational demand, positive environment factors, dysfunctional systemic impact, and systemic attainment of the limits of adaptive reaction. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-21045 Wisconsin Univ., Madison.
AN ANALYSIS OF ECLIPSING BINARIES WITH SIGNIFICANT TIDAL DISTORTION Ph.D. Thesis
Joel Acree Eaton 1975 50 p
Avail: Univ. Microfilms Order No. 75-28004

Light curves for a number of well observed systems were fit using computer synthesized theoretical light curves in order to study atmospheric properties of the component stars. Those systems for which it was possible to derive limb-darkening coefficients (U Oph, VV Ori, V453 Cyg) have coefficients consistent with those derived from model stellar atmospheres. Stars studied for gravity darkening (U OPH, VV Ori, V Pup, IU Aur, LY Aur, MR Cyg) show a range of gravity exponents. Most are consistent with a gravity exponent around the theoretically expected value g = 1.0. VV Ori, however, has a significantly lower value (g = 0.3), while LY Aur has light curves much more highly distorted than would be expected from the normal gravity darkening law. It is established that binary components with extended atmospheres can have significantly greater gravity darkening effects than stars of the same size with plane-parallel atmospheres. Dissert. Abstr.

N76-21046 California Univ., Los Angeles.
THE DETERMINATION OF STRUCTURES AND LOCATIONS OF CLUSTERS OF GALAXIES THROUGH THE USE OF STATISTICAL TECHNIQUES Ph.D. Thesis
Ronald Joseph Richard 1975 198 p
Avail: Univ. Microfilms Order No. 76-5127

Photographic plates which are centered on the Corona Borealis cluster of galaxies, and which extend over an area of the sky somewhat larger than that which the cluster is suspected to encompass, were used to develop an alternative way to investigate clusters of galaxies. The raw data are the measured coordinates of galaxy images. Least-squares fits to theoretical models of the data are used to determine which models of the cluster-field combination best fit the data; Galaxies which have a high probability of belonging to the cluster are deleted from the region. This process is carried out for all of the clearly apparent clusters. The distribution of the remaining galaxies is then analyzed to see if there appear to be any additional clusters. If there are, these are also analyzed by the least-squares technique and then deleted. This procedure is continued until there are no more clusters apparent on the plate. Dissert. Abstr.

N76-21047 Massachusetts Univ., Amherst.
A HIGH SENSITIVITY PULSAR SEARCH Ph.D. Thesis
Russell Alan Hulse 1975 155 p
Avail: Univ. Microfilms Order No. 76-5345

The planning, implementation, and results from a highly sensitive, automated search for new pulsars were discussed, starting with a study of the relevant signal detection theory. The general procedures developed were specifically tailored for use on a high speed minicomputer, and produced a search relatively free from observational selection effects. The actual computer coding of these procedures is also described, with emphasis on how the required speed and efficiency of these routines was obtained. Use of this search system at the 1,000 foot telescope of the Arecibo Observatory resulted in the detection of 50 pulsars, 40 of which were not previously known. Parameters are presented for these new pulsars. By far the most interesting individual pulsar discovered in the course of this search was PSR 1913+16. Large periodic variations in the observed pulsation period of this pulsar are interpreted in terms of Doppler shifts associated with its orbital motion about some companion object. Dissert. Abstr.

N76-21048# Los Alamos Scientific Lab., N.Mex.
CEPHEID PULSATION THEORY AND MULTIPERIODIC CEPHEID VARIABLES
A. N. Cox and J. P. Cox 1975 21 p refs Presented at 29th Colloq. of the IAU Multiple Periodic Variable Stars, Budapest, 1 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1625; Conf-750940-1) Avail: NTIS HC $4.25

A review of the multiperiodic Cepheid variables is presented. The subject matter is divided into four parts. The first discusses general causes of pulsation of Cepheids and other variable stars,

and their locations on the Hertesprung-Russell diagram. In the second section, the linear adiabatic and nonadiabatic theory calculation of radial pulsation periods and their application to the problem of masses and double-mode Cepheids are reviewed. Periodic solutions, and their stability, of the nonlinear radial pulsation equations for Cepheids and RR Lyrae stars are considered in the third section. The last section provides the latest results on nonlinear, nonperiodic, radial pulsations for Cepheids and RR Lyrae stars. NSA

N76-21049# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AFCRL INFRARED SKY SURVEY. VOLUME 1: CATALOG OF OBSERVATIONS AT 4, 11, AND 20 MICRONS Environmental Research Papers
Russell G. Walker 14 Jul. 1975 157 p refs
(AF Proj. 7670)
(AD-A016397; AFCRL-TR-75-0373-Vol-1; AFCRL-ERP-522-Vol-1) Avail: NTIS CSCL 03/2

A survey of the sky in the intermediate infrared spectral region is reported. The objective was to obtain the brightness and spatial distribution of a representative sample of the types of celestial objects that emit strongly in the infrared. Of primary concern was the determination of the positions of unusual sources of emission with sufficient accuracy to enable them to be acquired by ground based telescopes for further detailed investigation. GRA

N76-21050# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
STUDY OF ERRORS IN ABSOLUTE FLUX DENSITY MEASUREMENTS OF CASSIOPEIA A
Motohisa Kanda Oct. 1975 35 p refs
(PB-246933/6; NBSIR-75-822) Avail: NTIS HC $4.00 CSCL 03B

An error analysis for absolute flux density measurements of Cassiopeia A is discussed. The lower-bound quadrature-accumulation error for state-of-the-art measurements of the absolute flux density of Cas A around 7 GHz is estimated to be 1.71% for 3 sigma limits. The corresponding practicable error for the careful but not state-of-the-art measurement is estimated to be 4.46% for 3 sigma limits. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-21051*# Scientific Translation Service, Santa Barbara, Calif.
DETERMINATION OF THE MAGNETIC FIELD UNDER ASTROPHYSICAL CONDITIONS DUE TO POLARIZATION OF THE ATOMIC FLUORESCENCE
A. A. Ruzmaykin Washington NASA Feb. 1976 22 p refs Transl. into ENGLISH from Acad. of Sciences USSR, Inst. of Appl. Math. (Moscow), Preprint no. 62, 1975 p 1-25
(Contract NASw-2791)
(NASA-TT-F-16827) Avail: NTIS HC $3.50 CSCL 03B

Polarization of atomic fluorescence is sensitive to the action of weak magnetic fields. In the case of excitation by light over a wide interference spectrum, the sigma component for the quasi-degenerate level gives a linearly-polarized line with a rotating polarization plane. The rotation angle and the degree of polarization are determined by the magnitude of the magnetic field. This effect may be used in astrophysics for recording weak magnetic fields. Estimates are made of the effect for different astronomical objects. Author

N76-21052*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STUDY OF COMETS, PART 1
B. Donn, ed., M. Mumma, ed., W. M. Jackson, ed. (Howard Univ.), M. AHearn, ed. (Maryland Univ.), and R. Harrington, ed. (Naval Obs.) Washington 1976 557 p refs Presented at Proc. of IAU Colloq. No. 25, Greenbelt, Md., 28 Oct. - 1 Nov. 1974; co-sponsored by COSPAR 2 Vol.
(NASA-SP-393-Pt-1) Avail: NTIS MF $2.25; SOD HC $11.25 per set CSCL 03B

Papers are presented dealing with observations of comets. Topic discussed include: photometry, polarimetry, and astrometry of comets; detection of water and molecular transitions in comets; ion motions in comet tails; determination of comet brightness and luminosity; and evolution of cometary orbits. Emphasis is placed on analysis of observations of comet Kohoutek. For individual titles, see N76-21053 through N76-21074.

N76-21053* Erlangen-Nuremberg Univ. (West Germany).
PHOTOMETRY OF THE COMETARY ATMOSPHERE: A REVIEW
V. Vanysek *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 1-49 refs (For availability see N76-21052 11-90)
CSCL 03B

Photometry and polarimetry of the cometary heads one of the most important sources of information about the physical processes in comets is reviewed. Methods of inspection discussed include: narrow band photometry, wide band photometry, color photography, tilting filter techniques, and photoelectric spectrum scanning. Results of photoelectric observations of comets are described including photoelectric and infrared measurements of comet Kohoutek. Photometric profiles of the coma in monochromatic light are used to determine the lifetime of the parent molecules for the observed radicals, CN and C2. J.M.S.

N76-21054* Erlangen-Nuremberg Univ. (West Germany).
PHOTOELECTRIC PHOTOMETRY OF COMET KOHOUTEK (1973f)
Lubos Kohoutek *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 50-69 refs (For availability see N76-21052 11-90)
CSCL 03B

Comet Kohoutek was observed with the 50 cm (f/15) reflecting telescope of the European Southern Observatory, La Silla, Chile, on fourteen nights between January 16 and 30, when the heliocentric and geocentric distances of the comet were r = 0.66 - 1.00 A.U. and delta = 0.81 - 0.96 A.U., respectively. The 40 inch and 80 inch diaphragms were used for the photometry of the cometary head in the UBV system and with six interference filters. The atmospheric conditions were good but the accuracy of observations was low due to large extinction and twilight. The mean error of one measurement of log F in all but Na 5893 A filters can be estimated at plus or minus 0.02, whereas the accuracy through the Na filter was substantially lower. Author

N76-21055* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NARROW BAND PHOTOMETRY OF COMET KOHOUTEK
Larry W. Brown *In its* The Study of Comets, Part 1 1976 p 70-91 refs (For availability see N76-21052 11-90)
CSCL 03B

Photometric observations of the coma of comet Kohoutek were made at the Cassegrain focus of a 36-inch telescope. The observations consisted of one wide (visual, 5454 A) and six narrow (CN, 3879 A; C3, 4057 A; C2, 4732 A, 5165 A, 5634 A; continuum, 5200 A) band interference filters. In addition each filter was used with six diaphragms. Good quality data were obtained on 13 days between November 1973 and February 1974. A small flare was observed on 1 December for all filters, a CN flare on 13 January, and a visual flare on 28 January. The data were reduced to absolute narrow band magnitudes of the comet for the 13 days. The radial dependence of the surface brightness was derived from the set of diaphragms and future work will be directed toward using these results for modeling density distributions for the coma. Author

N76-21056* State Univ. of New York, Albany.
PHOTOELECTRIC POLARIMETRY OF THE TAIL OF COMET IKEY-SEKI (1975 VIII)
J. L. Weinberg and D. E. Beeson *In* NASA. Goddard Space Flight Center The Study of Comets, part 1 1976 p 92-120 refs (For availability see N76-21052 11-90)
(Grants NsG-676; NsG-7093)
CSCL 03B

Post-perihelion measurements of Comet 1965 VIII made on

four nights in October-November 1965 using a Fabry photometer atop 3,052 m Mt. Haleakala, Hawaii are described. Detailed results of observations at 5300A on October 29, 1965 are presented. Author

N76-21057* Lowell Observatory, Flagstaff, Ariz.
COMET DATA COLLECTIONS
H. L. Giclas *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 127-135 (For availability see N76-21052 11-90)
CSCL 03B

Various collections of comet observational material are discussed in terms of developing a data base. Emphasis is placed on observational material buried in the archives of the older observatories. J.M.S.

N76-21058* California Univ., Santa Cruz.
REVIEW OF COMETARY SPECTRA
George H. Herbig *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 136-158 refs (For availability see N76-21052 11-90)
CSCL 03B

The spectra of comet Kohoutek, comet Bradfield, and comet Mrkos are reviewed and compared in relation to stellar spectroscopy and evolution. The possibility of observing the absorption spectrum of a comet and direct measurement of Doppler shifts due to expansion or streaming motions in comets are considered along with the spectra of giant comets, such as, comet Minkowski, comet Baade, and comet Lovas. A speculative explanation for possible intrinsic abundance differences between comets is given. J.M.S.

N76-21059* Erlangen-Nuremberg Univ. (West Germany).
SPECTROSCOPIC OBSERVATIONS OF COMET KOHOUTEK (1973f)
Lubos Kohoutek and Jurgen Rahe *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 159-181 refs (For availability see N76-21052 11-90)
CSCL 03B

Coude spectrograms of comet Kohoutek obtained with the ESO 152-cm telescope in La Silla, Chile are discussed. Emission features of the C3, CH, and CO(+) molecules found in the blue region of the spectrum are considered along with measured emissions in the visual region of the spectrum. The observational and cometary data are given in tabular form. J.M.S.

N76-21060* Osservatorio Astrofisico, Asiago (Italy).
SPECTROSCOPIC OBSERVATIONS OF COMET KOHOUTEK (1973f), 2
Piero Benvenuti *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 185-198 refs (For availability see N76-21052 11-90)
CSCL 03B

Spectroscopic observations of comet Kohoutek at the Asiago Astrophysical Observatory are described. Spectra cover six nights before perihelion and five nights after perihelion. The spectra of the coma and tail of comet Kohoutek are characterized by fairly strong, asymmetric H2O(+) emissions in the red and the near infrared spectral regions and by the appearance of the [01] forbidden lines at 6300-6364 A, already at heliocentric distance r=1.55 A.U. These peculiarities suggest that some differences in chemical abundances or in physical conditions exist between comet Kohoutek and other comets. J.M.S.

N76-21061* Tel-Aviv Univ. (Israel).
H2O(+) IONS IN COMETS: COMET KOHOUTEK (1973f) AND COMET BRADFIELD (1974b)
Peter Wehinger and Susan Wyckoff *In* NASA Goddard Space Flight Center The Study of Comets, Part 1 1976 p 199-205 refs (For availability see N76-21052 11-90)
CSCL 03B

The image tube Cassegrain slit spectra of comet Kohoutek and Bradfield calibrated and reduced to relative intensities are discussed. Monochromatic changes in the surface brightness for various neutral and ionized molecules are determined. The intensities of C2 and CN decreased approximately four times faster than the intensity change for the H2O(+) features. It is shown that the excitation mechanism for the observed H2O(+) bands is by fluorescent scattering of the incident solar radiation. The effects of solar activity on the photoionization rate of H2O in a comet are discussed. Observations of another bright comet at the time of maximum solar activity are needed to determine changes in band intensities of comet tail ions due to solar activity. J.M.S.

N76-21062* Uttar Pradesh State Observatory, Naini Tal (India).
SPECTROPHOTOMETRY OF COMET KOHOUTEK (1973f) DURING PRE-PERIHELION PERIOD
G. S. D. Babu *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 220-231 refs (For availability see N76-21052 11-90)
CSCL 03B

Scans of the head of comet Kohoutek obtained during the pre-perihelion period with a photoelectric spectrum scanner are discussed. The mean relative flux distributions and the continuum energy distribution of the head of comet Kohoutek are given and normalized to 479 nm. The emission features of CN, C3, C2, and the principal Swan band sequences of C2 and Na are identified and discussed. The adopted monochromatic values relative to 479 nm are given and plotted along with the energy distribution of the sun. J.M.S.

N76-21063* Illinois Univ., Urbana.
RADIO DETECTIONS OF COMETARY MOLECULAR TRANSITIONS: A REVIEW
Louis E. Snyder *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 232-252 refs (For availability see N76-21052 11-90)
(Grant NSF GP-34200)
CSCL 03B

Radio detections of CH, OH, HCN, CH3CN, and several unidentified species in comet Kohoutek and the detection of H2O emission from comet Bradfield are discussed in terms of the similarities and differences between cometary molecules and interstellar molecules. Emphasis is placed on excitation and chemistry. The observed projected densities and resulting gas production rates are considered along with the feasibility of future radio molecular observations of comets. Author

N76-21064* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETECTION OF MOLECULAR MICROWAVE TRANSITIONS IN THE 3 mm WAVELENGTH RANGE IN COMET KOHOUTEK (1973f)
David Buhl, Walter F. Huebner (Los Alamos Scientific Lab., New Mexico), and Lewis E. Snyder (Illinois Univ., Urbana) *In its* The Study of Comets, Part 1 1976 p 258-271 refs Sponsored in part by ERDA (For availability see N76-21052 11-90)
(Contract NSF GP-34200)
CSCL 03B

Observations of comet Kohoutek made with a 3-mm line receiver mounted on the 11-m NRAO radio dish at Kitt Peak are presented. The detection of line transitions of hydrogen cyanide and methyl cyanide is reported and discussed along with the variability of neutral gas jets. Microwave transitions in molecules of cometary origin are also examined. Author

N76-21065* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO DETECTION OF H2O IN COMET BRADFIELD (1974b)
William M. Jackson (Howard Univ.), T. Clark, and Bertram Donn *In its* The Study of Comets, Part 1 1976 p 272-280 refs (For availability see N76-21052 11-90)
CSCL 03B

Results of observations of comet Bradfield using the Haystack telescope are summarized with emphasis on the detection of the 1.35 cm emission line of water in the comet. The excitation of water and methyl cyanide in comets is briefly considered. J.M.S.

N76-21066* Colorado Univ., Boulder.
ON THE COMETARY HYDROGEN COMA AND FAR UV EMISSION
H. U. Keller *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 287-314 refs (For availability

see N76-21052 11-90)
(Grant NGR-06-003-179)
CSCL 03B

Cometary hydrogen observations are reviewed with emphasis on observations of comet Bennett. The results are theoretically interpreted and a brief summary of ultraviolet observations other than Lyman alpha is given. Author

N76-21067* Minnesota Univ., Minneapolis.
PHOTOMETRIC OBSERVATIONS OF RECENT COMETS
Edward P. Ney *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 334-356 refs (For availability see N76-21052 11-90)
CSCL 03B

Infrared observations of comet Bennett, Kohoutek, Bradfield, and Encke are analyzed with emphasis on the detection of the silicate emission feature. Results are summarized. J.M.S.

N76-21068* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REVIEW: OBSERVATIONS OF RECENT COMETS, ION TAILS
John C. Brandt *In its* The Study of Comets, Part 1 1976 p 361-369 refs (For availability see N76-21052 11-90)
CSCL 03B

Photographic plates of the moving structures in the cometary tail are examined. Several divergent explanations for the case of comet Kohoutek are presented. It is suggested that these hypotheses be tested by observing the motion of the material spectroscopically by means of the Doppler effect. J.M.S.

N76-21069* National Aeronautics and Space Administration. Goddard Space Flight Center, Albuquerque, N. Mex.
A KINEMATOGRAPHIC STUDY OF THE TAIL OF COMET KOHOUTEK (1973f)
Klauss Jockers (Air Force Cambridge Res. Lab., Sunspot, N. Mex.), Robert G. Roosen (Hawaii Univ.), and D. P. Cruikshank *In its* The Study of Comets, Part 1 1976 p 370-377 refs (For availability see N76-21052 11-90)
CSCL 03B

Observations of comet Kohoutek made in the Southwest U.S., Alaska and Hawaii were combined to produce a movie of the cometary tail. Plasma tail motions seen in the movie are described. Features of the plasma tail discussed include: tail rays; wave trains; and condensations and kinks. J.M.S.

N76-21070* Arizona Univ., Tucson.
LUMINOSITY AND ASTROMETRY OF COMETS: A REVIEW
Elizabeth Roemer *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 380-409 refs (For availability see N76-21052 11-90)
CSCL 03B

Visual and photographic observations of the brightness of comets are reviewed including methods and sources of errors. Nuclear magnitude estimates are discussed and interpreted in relation to determination of appropriate exposure times for photographic observations. The importance of brightness ephemarides is emphasized. J.M.S.

N76-21071* State Univ. of New York, Geneseo.
COMET BRIGHTNESS PARAMETERS: DEFINITION, DETERMINATION, AND CORRELATIONS
David D. Meisel and Charles S. Morris (Purdue Univ.) *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 410-444 refs (For availability see N76-21052 11-90)
CSCL 03B

The power-law definition of comet brightness is reviewed and possible systematic influences are discussed that can affect the derivation of m sub o and n values from visual magnitude estimates. A rationale for the Bobrovnikoff aperture correction method is given and it is demonstrated that the Beyer extrafocal method leads to large systematic effects which if uncorrected by an instrumental relationship result in values significantly higher than those derived according to the Bobrovnikoff guidelines. A series of visual brightness parameter sets are presented which have been reduced to the same photometric system. Recommendations are given to insure that future observations are reduced to the same system. Author

N76-21072* Denver Univ., Colo.
THE EVOLUTION OF COMET ORBITS
Edgar Everhart *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 445-464 refs (For availability see N76-21052 11-90)
CSCL 03B

The origin of comets and the evolution of their orbits are discussed. Factors considered include: the law of survival of comets against ejection on hyperbolic orbits; short-period comets are not created by single close encounters of near-parabolic comets with Jupiter; observable long-period comets do not evolve into observable short-period comets; unobservable long-period comets with perihelia near Jupiter can evolve into observable short-period comets; long-period comets cannot have been formed or created within the planetary region of the solar system (excluding the effects of stellar perturbations); it is possible that some of the short-period comets could have been formed inside the orbit of Neptune; circularly-restricted three-body problem, and its associated Jacobi integral, are not valid approximations to use in studying origin and evolution of comets. Author

N76-21073* Smithsonian Astrophysical Observatory, Cambridge, Mass.
NONGRAVITATIONAL FORCES ON COMETS
Brian G. Marsden *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 465-488 refs (For availability see N76-21052 11-90)
CSCL 03B

Methods are presented and discussed for determining the effects of nongravitational forces on the orbits of comets. These methods are applied to short-period and long-period comets. Results are briefly described. J.M.S.

N76-21074* Institute for Theoretical Astronomy, Leningrad (USSR).
REVIEW OF INVESTIGATIONS PERFORMED IN THE USSR ON CLOSE APPROACHES OF COMETS TO JUPITER AND THE EVOLUTION OF COMETARY ORBITS
E. I. Kazimirchak-Polonskaya *In* NASA. Goddard Space Flight Center The Study of Comets, Part 1 1976 p 490-536 refs (For availability see N76-21052 11-90)
CSCL 03B

Methods are reviewed for calculating the evolution of cometary orbits with emphasis on the orbital changes that take place when comets pass within the spheres of action of giant planets. Topics discussed include: differences and difficulties in methods used for the calculation of large perturbations by Jupiter; the construction of numerical theories of motion covering the whole period of observations of each comet, allowing for planetary perturbations and the effects of nongravitational forces; and investigations of the evolution of cometary orbits over the 400 year interval 1660-2060. The classical theory of cometary capture is briefly discussed. J.M.S.

N76-21075*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STUDY OF COMETS, PART 2
B. Donn, ed., M. Mumma, ed., W. Jackson, ed. (Howard Univ.), M. Ahearn, ed. (Maryland Univ.), and R. Harrington, ed. (Naval Obs.) Washington 1976 557 p refs Presented at Proc. of IAU Colloq. No. 25, Greenbelt, Md., 28 Oct. - 1 Nov. 1974; co-sponsored by COSPAR 2 Vol.
(NASA-SP-393-Pt-2) Avail: NTIS MF $2.25; SOD HC $11.25 per set CSCL 03B

Flyby missions and systematic observations of comets are projected for studying comet nuclei and cometary dust tail structures. For individual titles, see N76-21076 through N76-21097.

N76-21076* Smithsonian Astrophysical Observatory, Cambridge, Mass.
A CONTINUING CONTROVERSY: HAS THE COMETARY NUCLEUS BEEN RESOLVED?
Zdenek Sekanina *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 537-585 refs (For availability

see N76-21075 11-90)
CSCL 03B

Evidence is presented for classifying cometary nuclei into two basic types, described by core mantle and coreless models. Mass loss related nongravitational effects in a comet's motion as a function of time are included in considering gradual evaporation of an icy envelope surrounding the meteoric matrix in the core of the nucleus. G.G.

N76-21077* California Univ., La Jolla.
ON THE ORIGIN OF COMETS
Asoka Mendis and Hannes Alfven *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 638-662 refs (For availability see N76-21075 11-90)
CSCL 03B

Physico-chemical processes leading to the dynamic formation and physical evolution of comets are reviewed in relationship to the various theories that propose solar origins, protoplanetary origins, planetary origins and interstellar origins. Evidence points to the origins of comets by the growth and agglomeration of small particles from gas and dust at very low temperatures at undetermined regions in space. G.G.

N76-21078* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMETS, INTERSTELLAR CLOUDS AND STAR CLUSTERS
Bertram Donn *In its* The Study of Comets, Part 2 1976 p 663-672 refs (For availability see N76-21075 11-90)
CSCL 03B

The association of comets with star formation in clusters is elaborated. This hypothesis is also used to explain origin and evaluation of the Oort cloud, the composition of comets, and relationships between cometary and interstellar molecules.
Author

N76-21079* Howard Univ., Washington, D.C. Dept. of Chemistry.
LABORATORY OBSERVATIONS OF THE PHOTOCHEMISTRY OF PARENT MOLECULES: A REVIEW
William M. Jackson *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 679-704 refs (For availability see N76-21075 11-90)
CSCL 03B

The photochemistry of possible parent molecules of comets has been reviewed. Quantum yields for many of the primary processes are unknown. Energy partitioning among the fragments has not been extensively investigated. A few of the studies have been performed as a function of the number of collisions that the excited molecules undergo, so that possible differences that may occur in a cometary environment may be ascertained.
Author

N76-21080* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER INDUCED PHOTOLUMINESCENCE SPECTROSCOPY OF COMETARY RADICALS
William M. Jackson (Howard Univ.), Regina J. Cody, and M. Sabety-Dzvonik *In its* The Study of Comets, Part 2 1976 p 706-710 refs (For availability see N76-21075 11-90)
CSCL 03B

Flash photolysis together with laser excitation of the product fragments was used in laboratory studies of cometary radicals. The LIPS method has been applied to the CN radical to determine: (1) Radiative lifetimes of individual rotational levels in the zeroth vibrational level of the B state; (2) energy partitioning during photodissociation of C2N2; and (3) vibrational and rotational excitation during formation of CN radicals in the photodissociation of dicyanoacetylene. G.G.

N76-21081* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE NEUTRAL COMA OF COMETS: A REVIEW
A. H. Delsemme *In its* The Study of Comets, Part 2 1976 p 711-752 refs (For availability see N76-21075 11-90)
CSCL 03B

The hypothesis that water snow controls the vaporization of the nucleus of some comets seems verified from the general order of magnitude of the size of their nucleus and of their nuclear albedo; the largest observed production rates are H and OH which both seem to originate from the photodissociation of H2O, as also confirmed by the scale length of the invisible parent molecule producing OH. However, comet Encke is not uniformly covered by water snow, as it produces only one tenth of the expected vaporization. Early results on comet Kohoutek suggest that the conclusions could be slightly different for some of the new comets in Oort's sense. If the far ultraviolet observations confirm the early assessments of the production rates of C, O and H, then at least another major constituent competing with water has not yet been detected. Such a major constituent is suggested by the ratios C/O = 0.24 and H/O = 2.5. Author

N76-21082* Harvard Coll. Observatory, Cambridge, Mass. Center for Astrophysics.
GAS PHASE CHEMISTRY IN COMETS
Michael Oppenheimer *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 753-762 refs (For availability see N76-21075 11-90)
CSCL 03B

The significance of gas phase reactions in determining the nuclear structure of comets is discussed. The sublimation of parent molecules such as H2O, CH4, CO2, and NH3 from the surface of the nucleus and their subsequent photodissociation and ionization in forming observed cometary molecular species are elaborated. G.G.

N76-21083* Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
NEUTRAL TEMPERATURE OF COMETARY ATMOSPHERES
Mikio Shimizu *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 763-772 refs (For availability see N76-21075 11-90)
CSCL 03B

Spectral analyses of the coma and type I tails of a comet indicate that the main constituent of a cometary atmosphere is H2O and that cometary nuclei are composed of dirty ice containing mainly CO and N2. Thermochemical calculations on strong infrared coupling between H2O and dust grains explain the dependence of atmospheric temperature on the distance of the comet from the sun considering the strong cooling effect of H2O. It is concluded that atmospheric temperatures of comets cannot be so high as 1500 K. G.G.

N76-21084* Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
FAR ULTRAVIOLET EXCITATION PROCESSES IN COMETS
Paul D. Feldman, Chet B. Opal (NRL), R. R. Meier (NRL), and K. R. Nicolas (NRL) *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 773-796 refs (For availability see N76-21075 11-90)
(Grant NGR-21-001-001)
CSCL 03B

Recent observations of atomic oxygen and carbon in the far ultraviolet spectrum of comet Kohoutek have demonstrated the existence of these atomic species in the cometary coma. However, in order to identify the source of their origin, it is necessary to relate the observed ultraviolet flux to the atomic production rate. Analyses of observed OI wavelength 1304 and CI wavelength 1657 A multiplets have been carried out using high resolution solar spectra. Also examined is the possibility of observing ultraviolet fluorescence from molecules such as CO and H2, as well as resonance scattering either from atomic ions for which there are strong corresponding solar lines (CII) or from atoms for which there is an accidentical wavelength coincidence (SI).
Author

N76-21085* Liege Univ. (Belgium).
INTERPRETATION OF COMET SPECTRA
C. Arpigny *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 797-838 refs (For availability see N76-21075 11-90)
CSCL 03B

The spectra of comets are discussed by considering successively a number of molecules that have been studied recently: CN, CH, C2, C3, OH, CH(+). The first two of this list, CN and

CH, have been analyzed in greatest detail. A classification of the spectra of cometary heads is introduced. Author

N76-21086* National Bureau of Standards, Washington, D.C. Physical Chemistry Div.
ANALYSIS OF NH SPECTRUM
M. Krauss *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 848-852 refs (For availability see N76-21075 11-90)
CSCL 03B

The A3Pi to X3Sigma- transition of NH is a common feature of cometary spectra. Since the NH molecule is likely to be formed by photodissociation of molecules such as ammonia or hydrazine, identifying the final states of the photolysis would shed light on the identity of the parent. It is shown that the transition rate for the a 1Delta to X3Sigma- transition is sufficiently fast to deplete any a1Delta concentration formed in the original photolysis process. This analysis focused on experimental spectra obtained for the comet Kohoutek. The fluorescence pumping of the NH molecule is calculated for November 29, 1973 and January 25, 1974 using the model of radiative equilibrium which assumes no collisions. Author

N76-21087* Oxford Univ. (England). Mathematical Inst.
COOLING AND RECOMBINATION PROCESSES IN COMETARY PLASMA
M. K. Wallis and R. Ong *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 856-876 refs Sponsored in part by UKAEA (For availability see N76-21075 11-90)
(Grant AF-AFOSR-2224-72)
CSCL 03B

The ion electron plasma in comets is examined for cooling processes which result from its interactions with the neutral coma. A cometary coma model is formulated that is composed predominantly of H2O and its decomposition products where electrons are cooled in a variety of processes at rates varying with energy. It is shown that solar plasma plus accumulated cometary ions and electrons is affected very strongly as it flows into the coma. The electrons are rapidly cooled and all but some 10% of the ions undergo charge exchange. Photodissociation of H2O is assumed where ion electron recombination is the dominant loss process. G.G.

N76-21088* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE WIND-SOCK THEORY OF COMET TAILS
John C. Brandt and Edward D. Rothe *In its* The Study of Comets, Part 2 1976 p 878-892 refs (For availability see N76-21075 11-90)
CSCL 03B

A method is reported for calculating the shapes of ionic comet tails that use the magnetic field along the tail to channel the tail plasma. The local momentum field in the solar wind determines magnetic field line locations along the tail. Thus, the magnetic field acts as a transparent wind sock in trapping field lines in the cometary plasma around the nucleus long enough to be effectively fastened to the comet's head. G.G.

N76-21089* Smithsonian Astrophysical Observatory, Cambridge, Mass.
PROGRESS IN OUR UNDERSTANDING OF COMETARY DUST TAILS
Zdenek Sekanina *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 893-942 refs (For availability see N76-21075 11-90)
(Grant NGR-09-015-159)
CSCL 03B

Various analytical techniques are employed to analyze observations on the character, composition, and size distribution of solid particles in cometary dust tails. Emphasized is the mechanical theory that includes solar gravitational attraction and solar radiation pressure to explain dust particle motions in cometary tails, as well as interactions between dust and plasma. G.G.

N76-21090* Martin Marietta Corp., Denver, Colo.
HISTORY OF THE DUST RELEASED BY COMETS
Bruno J. Jambor *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 943-948 refs (For availability see N76-21075 11-90)
CSCL 03B

The Finson-Brobstein theory is used to examine production and history of dust released from periodic comets and to compare dust size distribution in relation to the Zodiacal cloud. Results eliminate all of the bright new comets from contributors to the Zodiacal cloud. Among the periodic comets, all particles of size much smaller than 10 micrometer are also lost. Only the large particles remain as possible contributors. G.G.

N76-21091* Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
PARTICLES FROM COMET KOHOUTEK DETECTED BY THE MICROMETEOROID EXPERIMENT ON HEOS 2
H.-J. Hoffmann, H. Fechtig, Eberhard Gruen, and J. Kissel *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 949-961 refs (For availability see N76-21075 11-90)
CSCL 03B

HEOS B measurements on particles ejected from comet Kohoutek reflect average particle rate as a function of particle speed and mass in relation to random distribution with known speed from the interplanetary region. The micrometeoroid experiment detector onboard the satellite passed through the orbital plane of the comet and encountered ejected particles for approximately two months. G.G.

N76-21092* Washington Univ., Seattle. Dept. of Astronomy.
PHYSICAL PROPERTIES OF INTERPLANETARY GRAINS
Don E. Brownlee, F. Horz, D. A. Tomandl, and P. W. Hodge *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 962-982 refs (For availability see N76-21075 11-90)
CSCL 03B

Morphological analyses of micrometeorite craters found on lunar rocks and laboratory simulation experiments are used to formulate a meteoritic interplanetary dust particle for optical scattering calculations that is roughly spherical and has a density of 2g cm/3. The model particle has chondritic elemental abundances and also contains a high content of finely dispersed carbon. Author

N76-21093* Computer Sciences Corp., Silver Spring, Md.
ORBITAL ERROR ANALYSIS FOR COMET ENCKE, 1980
D. K. Yeomans *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 983-995 refs (For availability see N76-21075 11-90)
CSCL 03B

Before a particular comet is selected as a flyby target, the following criteria should be considered in determining its ephemeris uncertainty: (1) A target comet should have good observability during the apparition of the proposed intercept; and (2) A target comet should have a good observational history. Several well observed and consecutive apparitions allow an accurate determination of a comet's mean motion and nongravitational parameters. Using these criteria, along with statistical and empirical error analyses, it has been demonstrated that the 1980 apparition of comet Encke is an excellent opportunity for a cometary flyby space probe. For this particular apparition, a flyby to within 1,000 km of comet Encke seems possible without the use of sophisticated and expensive onboard navigation instrumentation. Author

N76-21094* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPECTED SCIENTIFIC RESULTS ON BALLISTIC SPACECRAFT MISSIONS TO COMET ENCKE DURING THE 1980 APPARITION
Michael J. Mumma *In its* The Study of Comets, Part 2 1976 p 997-1032 refs (For availability see N76-21075 11-90)
CSCL 03B

Summarized are three proposed ballistic spacecraft missions to intercept P/Encke during the 1980 apparition. A baseline physical activity model for P/Encke is established and the performances of the neutral mass spectrometer and of the imaging experiment on each intercept mission are assessed. Author

N76-21095* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MISSION STRATEGY FOR COMETARY EXPLORATION IN THE 1980'S
Robert W. Farquhar *In its* The Study of Comets, Part 2 1976 p 1033-1057 refs (For availability see N76-21075 11-90)
CSCL 03B

A specific plan for a sequence of cometary intercept missions in the 1980's is reported. Each mission is described in detail and the supporting role of ground based cometary observations is included. Only three launches are required in the proposed mission sequence for six cometary encounters with comets Encke, Giacobini-Zinner, Borrelly and Halley. Cometary ephemerics errors are reduced to very small values because of a favorable earth-comet orbital geometry for Encke 1980, and excellent earth based sighting conditions exist for the entire 1985 mission set. Author

N76-21096* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENCE ASPECTS OF 1980 BALLISTIC MISSIONS TO COMET ENCKE, USING MARINER AND PIONEER SPACECRAFT
Leonard D. Jaffe, C. Elachi, C. E. Giffin, W. Huntress, Ray L. Newburn, Jr., R. H. Parker, F. W. Taylor, and T. E. Thorpe *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 1058-1070 refs (For availability see N76-21075 11-90)
(Contract NAS7-100)
CSCL 03B

Science aspects of a 1980 spacecraft reconnaissance of Comet Encke are considered. The mission discussed is a ballistic flyby (more exactly, a fly-through) of P/Encke, using either a spin stabilized spacecraft, without despin of instruments, or a 3-axis stabilized spacecraft. Author

N76-21097* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SCIENTIFIC POSSIBILITIES OF A SOLAR ELECTRIC POWERED RENDEZVOUS WITH COMET ENCKE
Ray L. Newburn, Jr., C. Elachi, F. P. Fanale, C. E. Giffin, Leonard D. Jaffe, R. H. Parker, F. W. Taylor, and T. E. Thorpe *In* NASA. Goddard Space Flight Center The Study of Comets, Part 2 1976 p 1071-1083 refs (For availability see N76-21075 11-90)
CSCL 03B

The minimum scientific spacecraft instrumentation is considered that is likely to result in as complete an understanding of the composition, structure, and activity of a cometary nucleus as is possible without landing on it. The payload will also give useful results on secondary goals of a better understanding of physical processes in the inner and outer coma. Studies of composition, by means of an actual landing on the surface, details of the internal structure of the nucleus, and sample return were considered beyond the scope of this mission. Author

N76-21098# California Univ., Livermore. Lawrence Livermore Lab.
MAGNETOHYDRODYNAMICS NEAR A BLACK HOLE
J. R. Wilson 14 Aug. 1975 33 p refs Presented at Meeting on the Recent Progr. of the Fundamentals of Gen. Relativity Miramare, Trieste, Italy Sponsored by ERDA
(UCRL-76961; Conf-750734-1) Avail: NTIS HC $4.75

A numerical computer study of hydromagnetic flow near a black hole is presented. First, the equations of motion are developed to a form suitable for numerical computations. Second, the results of calculations describing the magnetic torques exerted by a rotating black hole on a surrounding magnetic plasma and the electric charge that is induced on the surface of the black hole are presented. Author (NSA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-21099 Stanford Univ., Calif.
LUNAR STRUCTURE AND SEISMICITY AT THE APOLLO 17 LANDING SITE Ph.D. Thesis
Michael Ralph Cooper 1975 248 p
Avail: Univ. Microfilms Order No. 76-5714

Reexamination of the seismograms of the Lunar Seismic Profiling Experiment on the Apollo 17 lunar mission has yielded a revised shallow velocity structure for the lunar crust. The seismograms were processed in two ways: (1) by prediction error filtering to remove noise of known spectral characteristics, and (2) by subtracting a model of the noise waveform from the data. The more accurate travel-times resulted in the following P-velocity model: 100 m/sec (4 m thick), 327 m/sec (28 m thick), 495 m/sec (358 m thick), 960 m/sec (995 m thick), and 4,700 m/sec (undetermined thickness). The corresponding geologic model is: 4 m of lunar regolith, on top of 28 m of rubble, overlying about 1,300 m of basalt which has been extensively fractured near the top. The high velocity basement is probably coherent anorthositic breccia. The rapid increase in velocity with depth precludes the possibility that the upper few kilometers of the moon consist of cold-compacted powders. Dissert. Abstr.

N76-21100*# Texas A&M Univ., College Station. Dept. of Physics.
SCATTERING IN THE ATMOSPHERE OF VENUS. LINE PROFILES AND PHASE CURVES FOR RAYLEIGH SCATTERING
L. D. G. Young and George W. Kattawar 17 Mar. 1976 21 p refs Submitted for publication
(Grant NGR-44-001-117)
(NASA-CR-146535; Rept-25) Avail: NTIS HC $3.50 CSCL 03B

Spectral line profiles, curves of growth, and curves for the equivalent width of a line as a function of Venus phase angle are computed for a Rayleigh scattering cloud and compared with those for a cloud of isotropic scatterers. The results are similar for the two kinds of scattering, with the exception for the curves of equivalent width as a function of Venus phase angle. These latter curves exhibit the inverse phase effect and rule out the possibility that the scale height of the clouds can be much less than half the scale height of the gas. Author

N76-21101*# Scientific Translation Service, Santa Barbara, Calif.
CLOUDS ON MARS: CERTAIN CONCLUSIONS FROM OBSERVATIONS ON MARS-3
V. I. Moroz Washington NASA Apr. 1976 28 p refs Transl. into ENGLISH from Russian Report PR-235 (Moscow), 1975 28 p
(Contract NASw-2791)
(NASA-TT-F-16968; PR-235) Avail: NTIS HC $4.00 CSCL 03B

Some physical parameters of Martian clouds were evaluated on the basis of narrowband photoelectric photometers on Mars-3. Three different methods were used for evaluation of mean size of particles: from changes of contrasts of dark and light regions, from time of dissipation of clouds and from single-scattering albedo. Author

N76-21102*# Kanner (Leo) Associates, Redwood City, Calif.
ON THE STRUCTURE OF THE MARTIAN SOIL FROM OPTICAL AND INFRARED OBSERVATIONS
V. I. Moroz Washington NASA Mar. 1976 27 p refs Transl. into ENGLISH from Russian report PR-234 (Moscow), 1975 27 p
(Contract NASw-2790)
(NASA-TT-F-16969; PR-234) Avail: NTIS HC $4.00 CSCL 03B

The spectrum of reflected radiation and the thermophysical properties of the Martian soil are used to develop a model of the soil. The resulting model follows: (1) the Martian soil consists of particulate, basic and intermediate igneous rock, with a small admixture of geothite; the highland soil consists of more acid rocks than the mare soil; (2) the soil consists of two types of particles: comparatively large particles (tenths of a millimeter in size) and micron size particles; the large particles possibly are conglomerates of the small ones; and (3) the average soil density is about 1.22 g cu/cm at a depth of 2 to 4 cm, and porosity is about 0.6. Author

N76-21103*# Texas Univ. at Dallas, Richardson.
INVESTIGATION OF THE DAYTIME LUNAR ATMOSPHERE FOR LUNAR SYNTHESIS PROGRAM Semiannual Status Report, 1 Oct. 1974 - 31 Mar. 1976
R. R. Hodges, Jr. 31 Mar. 1976 22 p refs
(Grant NsG-7034)
(NASA-CR-146663) Avail: NTIS HC $3.50 CSCL 03B

Synthesis studies of the daytime lunar atmoshere were directed toward improved understanding of fundamental lunar atmospheric dynamics and the relationship of the detectable atmosphere to physical processes of the lunar surface and interior. The primary source of data is the Apollo 17 lunar surface mass spectrometer. The Ar40 is radiogenic and its escape rate from the lunar atmosphere requires release of a significant fraction (about 8%) of the argon produced from the decay of K40 within the moon. Furthermore the process of argon release from the solid moon is time varying and related to seismic activity. Most of the helium on the moon is due to release of implanted solar wind alpha particles from the regolith. Author

N76-21104*# Santa Clara Univ., Calif. Dept. of Physics.
PROPERTIES OF THE MOON AND ITS ENVIRONMENT FROM LUNAR MAGNETOMETER MEASUREMENTS Semiannual Progress Report, 1 Sep. 1975 - 29 Feb. 1976
Curtis W. Parkin 29 Feb. 1976 29 p refs
(Grant NsG-2075)
(NASA-CR-146585) Avail: NTIS HC $4.00 CSCL 03B

Lunar analysis of data from a total of nine lunar magnetometers is described. Results obtained concerning electromagnetic, compositional, and structural properties of the lunar interior are discussed. Specific topics covered include: lunar magnetic permeability and iron abundance; limits on a highly conducting lunar core; lunar electrical conductivity; and internal structure inferred from conductivity and permeability results. J.M.S.

N76-20571* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEODETIC AND DYNAMICAL PROPERTIES OF PLANETS
John D. Anderson *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 85-93 refs Repr. from Conf. Proc. E(Earth)S, v. 55, no. 5, May 1974 (For availability see N76-20566 11-42)
(Contract NAS7-100)
CSCL 03B

N76-20574* California Univ., Los Angeles. Dept. of Planetary and Space Sciences.
THE GRAVITY AND SHAPE OF THE MOON
William M. Kaula *In* Ohio State Univ. Res. Found. Proc. of the Geodesy/Solid Earth and Ocean Phys. (GEOP) Res. Conf. Sep. 1975 p 139-146 refs Repr. from Conf. Proc. E(Earth)S, v. 56, no. 6, Jun. 1975 (For availability see N76-20566 11-42)
(Contract NAS9-12757; Grants NGL-05-007-002; NGL-05-007-283)
(Publ-1392) CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-21105+ Observatoire de Paris-Meudon (France). Dept. de Radioastronomie.
REBUILDING THE NANCAY RADIOASTRONOMICAL STATION. RECONSTRUCTION OF A RADIOHELIOGRAPH Final Report - [REMISE EN ETAT DE LA STATION DE RADIOASTRONOMIE DE NANCAY. RECONSTRUCTION D'UN RADIOHELIOGRAPH]
Emile-Jacques Blum, Jean Bonmartin, Ian Jones, and Monique Pick Dec. 1974 136 p refs In FRENCH
(Contract DGRST-72-7-0512)
Avail: NTIS HC $6.00

An instrument for imaging the radiofrequency solar corona was reconstructed. Its main accomplishment is the speed of image retrieval up to a maximum of 200 per sec. The images are obtained after Fourier transform and phase correction of the signals received from a multicorrelator. Some technical achievements may be used in more general applications such as the Fourier transform device, which is an independent peripheral unit to the main computer. A digital display device of computer generated data falls in the same class. The astrophysical programs developed around the radioheliograph facility are outlined. For individual titles, see N76-21106 through N76-21108.

N76-21106 Observatoire de Paris-Meudon (France).
SPECIFICATION OF THE NEW HELIOGRAPH AT NANCAY [DEFINITION DU NOUVEAU RADIOHELIOGRAPHE DE LA STATION DE NANCAY]
In its Rebldg. The Nancay Radioastron. Sta. Mar. 1973 52 p In FRENCH (For availability see N76-21105 11-92)

The specifications for a new radioheliograph are detailed. The principles of one-dimensional and two-dimensional imaging are reviewed emphasizing the need for fast Fourier transformation and multicorrelation. The temporal and spatial resolution of the instrument are detailed. The structure of the receiving system is discussed together with the various elements of the numerical subsystem. Original methods for data acquisition and storage are described empasizing the need for data compression. ESA

N76-21107 Observatoire de Paris-Meudon (France).
MULTIFREQUENCY AND TWO-DIMENSIONAL RADIOHELIOGRAPH [RADIOHELIOGRAPHE A DEUX DIMENSIONS ET A MULTIFREQUENCES]
In its Rebldg. The Nancay Radioastron. Sta. Jun. 1973 25 p refs In FRENCH (For availability see N76-21105 11-92)

The astrophysical interest of a two-dimensional multifrequency radioheliograph is stressed with regard to solar quiet atmosphere emission, thermal emission of local structures, and nonthermal emissions as a function of the spectral range. The technical aspects for the implementation of the project are detailed with regard to the antenna network, down converters, analog correlation, analog to digital signal conversion, Fourier transform operator, and data acquisition and storage. The management plan is outlined and the importance of the instrument in an international context is reviewed. ESA

N76-21108 Observatoire de Paris-Meudon (France).
RADIOHELIOGRAPHY AT NANCAY: RESULTS AND PROJECTS [LA RADIOHELIOGRAPHIE A LA STATION DE NANCAY. RESULTATS ET PROJETS]
In its Rebldg. the Nancay Radioastron. Sta. Oct. 1974 41 p In FRENCH (For availability see N76-21105 11-92)

Some results obtained with the Nancay solar radioheliograph are presented briefly, together with various possible programs. The summarized results include observations of the quiet sun atmosphere at metric wavelengths and coronal pits, thermal emission and coronal jets, type 1 and type 3 bursts in relation to chromospheric activity and emission mechanisms, solar magnetic fields and arch formation, fine structure of radio bursts, and coronal sounding for electron density variation research. ESA

N76-21109*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE TRIGGERING AND SUBSEQUENT DEVELOPMENT OF A SOLAR FLARE
J. A. Vorpahl 31 Oct. 1975 27 p refs
(Contract NAS8-29602)
(NASA-CR-144228; ATR-76(7405)-1) Avail: NTIS HC $4.00 CSCL 03B

High temporal and spatial resolution solar X-ray pictures of a flare at 1827 UT on 5 September 1973 were taken with the

S-056 telescope on the Apollo telescope mount. Photographs taken at 9 sec intervals allow detailed information to be obtained about the site of the energy release, as well as about the evolution of the flare itself. Observations suggest that the flare occurred in an entire arcade of loops rather than in any single loop. Sequential brightening of different X-ray features indicates that some excitation moved perpendicular to the magnetic field of the arcade at velocities of 180 to 280 km/sec. The most intense X-ray features were located in places where the magnetic field composing the arcade had a small radius of curvature with horizontal field gradients higher than the surroundings region and where the axis of the arcade changed direction. It was felt that the arcade geometry strongly influenced the propagation of the triggering disturbance, as well as the storage and site of the subsequent deposition of energy. A magnetosonic wave is suggested as the propagating mechanism triggering instabilities that may have existed in the preflare structure. Author

N76-21110*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE CALCULATION OF THEORETICAL CHROMOSPHERIC MODELS AND PREDICTED OSO 1 SPECTRA Progress Report, 1 Jul. 1974 - 31 Dec. 1975
Eugene H. Avrett 31 Dec. 1975 24 p refs
(Grant NsG-7054)
(NASA-CR-146772; PR-1) Avail: NTIS HC $3.50 CSCL 03B

Theoretical solar chromospheric and photospheric models are computed for use in analyzing OSO 8 spectra. The Vernazza, Avrett, and Loeser (1976) solar model is updated and self-consistent non-LTE number densities for H I, He I, He II, C I, Mg I, Al I, Si I, and H(-) are produced. These number densities are used in the calculation of a theoretical solar spectrum from 90 to 250 nm, including approximately 7000 lines in non-LTE. More than 60,000 lines of other elements are treated with approximate source functions. Author

N76-21111*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
DIRECTION-FINDING MEASUREMENTS OF TYPE 3 RADIO BURSTS OUT OF THE ECLIPTIC PLANE Progress Report
Mark M. Baumback, William S. Kurth, and Donald A. Gurnett Dec. 1975 51 p refs Presented at Workshop on Mech. for Solar Type 3 Radio Bursts, Berkeley, Calif., 8-9 May 1975 Submitted for publication
(Contracts NAS1-13129; NAS5-11431; Grant NGL-16-001-043; Contract N00014-76-C-0016)
(NASA-CR-146574; U-of-Iowa-75-45) Avail: NTIS HC $4.50 CSCL 03B

Direction-finding measurements with the plasma wave experiments on the HAWKEYE 1 and IMP 8 satellites are used to find the source locations of type 3 solar radio bursts in heliocentric latitude and longitude in a frequency range from 31.1 kHz to 500 kHz. Using an empirical model for the emission frequency as a function of radial distance from the sun the three-dimensional trajectory of the type 3 radio source can be determined from direction-finding measurements at different frequencies. Since the electrons which produce these radio emissions follow the magnetic field lines from the sun these measurements provide information on the three-dimensional structure of the magnetic field in the solar wind. The source locations projected into the ecliptic plane follow an Archimedian spiral. Perpendicular to the ecliptic plane the source locations usually follow a constant heliocentric latitude. With direction-finding measurements of this type it is also possible to determine the source size from the modulation factor of the received signals. Author

N76-21112# Stanford Univ., Calif. Radio Astronomy Inst.
STUDY OF THE THREE CENTIMETER RADIO FREQUENCY EMANATION FROM THE SOLAR ATMOSPHERE
C. John Grebenkemper 18 Aug. 1975 34 p refs
(Contract F19628-74-C-0053; AF Proj. 7649)
(AD-A016568; AFCRL-TR-75-0452; Scientific-2) Avail: NTIS CSCL 03/2

Observations of the quiet sun and two solar active regions are discussed. The quiet sun is found to consist of a number of radio sources with lifetimes greater than two hours. Power spectra of the time variation of these sources reveal no periodicity. GRA

N76-21113# Stanford Univ., Calif. Inst. for Plasma Research.
FORCE FREE MAGNETIC FIELDS AND SOLAR ACTIVITY
P. A. Sturrock and C. W. Barnes Aug. 1975 18 p refs
(Contract F19628-74-C-0054; AF Proj. 7649)
(AD-A016566; AFCRL-TR-75-0474; Scientific-2) Avail: NTIS CSCL 03/2

This report, aimed at the prediction of solar flares, centers on devising methods for calculating magnetic field structures in the solar atmosphere. Force-free fields comprise an important class of magnetic-field structures which may be calculated by relaxation techniques. Models of force-free fields with cylindrical symmetry, based on a spherical boundary surface, were calculated. Evaluation of the energy of such structures provides information about the eruption of closed-field patterns to form open current sheets which can then lead to solar flares. GRA

N76-21114# Manila Observatory (Philippines).
SOLAR RADIO STUDIES AT MANILA OBSERVATORY Final Report, 1 Jan. 1973 - 30 Jun. 1975
V. L. Badillo, J. E. Salcedo, and E. R. Gallardo 31 Jul. 1975 11 p refs
(Contract F19628-73-C-0035; AF Proj. 4643)
(AD-A016567; AFCRL-TR-75-0443) Avail: NTIS CSCL 03/2

Distribution studies of flares, cm and dekameter radio bursts in the period 1970-72 show an Eastern Hemisphere preference by dekametric source sites. GRA

N76-21115# Boston Univ., Mass. Dept. of Astronomy.
BRIGHTNESS TEMPERATURES AND POLARIZATIONS OF SOLAR ACTIVE REGIONS AT 3.8 cm, THEORY AND OBSERVATIONS Final Report, 1 Sep. 1972 - 30 Jun. 1975
Michael D. Papagiannis and John A. Kogut Sep. 1975 158 p refs
(Contract F19628-73-C-0058; AF Proj. 4643)
(AD-A016490; SER-2-No-59; AFCRL-TR-75-0430) Avail: NTIS CSCL 03/2

Extensive observations (230 hours in 1973 and 1974) of right and left circularly polarized emission from solar active regions were carried out at 3.8 cm with the 120 ft Haystack antenna, which at this frequency has a resolution of about 4.4 arc minutes. The purpose of these observations was to study the changes in brightness temperature and polarization before flare activity in the hope of recognizing characteristic patterns which could be used as warning signals in the forecasting of major solar flare events. GRA

N76-21116# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE RELATIVE ABUNDANCE OF NEON AND MAGNESIUM IN THE SOLAR CORONA Interim Report
Hugo R. Rugge and Arthur B. C. Walker, Jr. 8 Oct. 1975 21 p refs
(Contract F04701-75-C-0076)
(AD-A016528; TR-0076(6960-01)-1; SAMSO-TR-75-237) Avail: NTIS CSCL 03/2

A technique is proposed for determining the relative solar coronal abundance of neon and magnesium. The relative abundance is calculated directly from the relative intensity of the resonance lines of NeX (12.134 A) and Mg XI (9.169 A) without the need for the development of a detailed model of the thermal structure of the corona. Relatively low resolution Bragg crystal spectrometer results from the OV1-10 satellite are used to determine a coronal neon to magnesium relative abundance of 1.47 plus or minus 0.38. GRA

N76-21117# National Geographic Society, Washington, D.C.
SOLAR-GEOPHYSICAL DATA NUMBER 374. PART 2, (COMPREHENSIVE REPORTS): DATA FOR APRIL 1975 - MARCH 1975 AND MISCELLANEA: EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975
Hope I. Leighton Oct. 1975 26 p
(PB-247137-374-2; SGD-374-Pt-2; NOAA-75111105) Avail: NTIS HC $4.00 CSCL 03B

Data include sections on solar flares, solar radio waves, and magnetograms of geomagnetic storms. The March 1975 data include sections on abbreviated calendar record, and regional

flare index. Miscellaneous data include sections on solar radio waves, and cosmic rays. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-21118 Washington Univ., Seattle.
THE DETECTION OF EXTREMELY HEAVY COSMIC RAYS Ph.D. Thesis
Mary Mellott Hoppe 1975 253 p
Avail: Univ. Microfilms Order No. 76-4758

Eighty tracks of heavily ionizing cosmic ray particles were collected during the high altitude balloon flight of a detector consisting of nuclear emulsion interleaved with plastic sheets. In the emulsions, charges for these particles were inferred from photometric measurements of the particle tracks; in the plastics, etching rate of tracks was used for the charge assignments. Comparisons made between the charges measured in various materials indicate some significant discrepancies. In general, for the same particle, the triacetates (TN and Kodacel) give the highest charge, followed by cellulose acetate butyrate (BN) and then by the Lexan and the emulsions, the last two being in essential agreement. The observed VVH fluxes for energies greater than 1 GeV/n varied between 1.7 and 3.4 times 0.000001 particles/sq m-ster-sec for values of Z between 36 and 85. For Z larger than or equal to 86, no flux was observed. Dissert. Abstr.

N76-21119 Washington Univ., Seattle.
ISOTOPIC AND ELEMENTAL ABUNDANCES OF HEAVY COSMIC RAYS Ph.D. Thesis
Julio Ciro Benegas 1975 150 p
Avail: Univ. Microfilms Order No. 76-4741

Results on the isotopic composition of calcium and iron were presented, as well as results on the composition and energy spectra of cosmic rays with charge between 12 and 28 and energy between 0.5 and 1.6 GeV/nucleon, and on the composition of ultraheavy cosmic rays with charge between 30 and 50. The data reported were collected in four high altitude balloon flights of an electronic cosmic ray detector. This detector consists of pulse-type ionization chambers, a Lucite Cerenkov detector, a liquid Cerenkov detector and a plastic scintillation hodoscope. The mean isotopic composition of iron shows that Fe-54 in the cosmic rays has a significantly stronger component than in the solar system. Ca is shown to have composition consistent with a pure Ca-40 source. Contrary to previous reports, the energy variation of the Si/Fe ratio was found to be negligible in the range of 0.5 to 1.6 GeV/nucleon. Dissert. Abstr.

N76-21120*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SEARCH OF THE SAS-2 DATA FOR PULSED GAMMA-RAY EMISSION FROM RADIO PULSARS
H. B. Ogelman (Middle East Tech. Univ.) and C. E. Fichtel Feb. 1976 29 p refs Submitted for publication
(NASA-TM-X-71090; X-662-76-51) Avail: NTIS HC $4.00 CSCL 03B

Data from the SAS-2 high energy gamma ray experiment were examined for pulsed emission from each of 75 radio pulsars which were viewed by the instrument and which have sufficiently well defined period and period derivative information from radio observations to allow for gamma ray periodicity searches. When gamma ray arrival times were converted to pulsar phase using the radio reference timing information, two pulsars, PSR 1747-46 and PSR 1818-04, showed positive effects, each with a probability less than 0.0001 of being a random fluctuation in the data for that pulsar. These are in addition to PSR 0531+21 and PSR 0833-45, previously reported. The results of this study suggest that gamma-ray astronomy has reached the detection threshold for gamma ray pulsars and that work in the near future should give important information on the nature of pulsars. Author

N76-21121# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF TRAPPED RADIATION ON THE KOSMOS-426. 1: SCIENTIFIC APPARATUS OF THE KOSMOS-426
V. A. Vorobev, S. N. Kuznetsov, I. N. Lysenko, B. I. Savin, and V. G. Stolpovskii 1975 5 p refs Transl. into ENGLISH from Kosmich. Issled (USSR), v. 13, no. 5, 1975 p 778-781
Avail: NTIS HC $3.50 National Translations Center, John Crerar Library, Chicago, Ill. 60616

Charged particle flux measurements were taken onboard Kosmos 426 for seven months. The KL-2 device, UER-1 device, and two radiation counters were used to measure the trapped particles. J.A.M.

N76-21122# National Environmental Satellite Service, Washington, D.C.
RADIATION BUDGET DATA FROM THE METEOROLOGICAL SATELLITES, ITOS 1 AND NOAA 1
Donald H. Flanders and William L. Smith Aug. 1975 26 p refs
(PB-246877/5; NOAA-TM-NESS-72; NOAA-75102201) Avail: NTIS HC $4.00 CSCL 04A

The procedures used to process the Flat Plate Radiometer data from the two satellites (ITOS 1 and NOAA 1) are described. The results are presented for the periods of good data acquisition: 23 March through 25 June 1970 for ITOS 1 and 18 February through 16 March and 10 May through 27 May 1971 for NOAA 1. GRA

99 GENERAL

N76-21123# European Space Agency, Paris (France).
LA RECHERCHE AEROSPATIALE. BI-MONTLY BULLETIN NO. 1975-2
Nov. 1975 121 p refs Transl. into ENGLISH of La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-2, Mar.-Apr. 1975 P 61-126 Original French report available from ONERA, Paris FF 30
(ESA-TT-205) Avail: NTIS HC $5.50

Topics covered are dispersive and dissipative properties of finite difference schemes for nonlinear hyperbolic systems, flow around an air inlet, metal plastic fatigue theory based on intrusion formation, characterization of the sound field of a hot jet from its infrared emission, and resonance computation of a water filled arbitrarily shaped tank. For individual titles, see N76-21124 through N76-21128.

N76-21124 European Space Agency, Paris (France).
DISPERSIVE AND DISSIPATIVE PROPERTIES OF A CLASS OF DIFFERENCE SCHEMES FOR NONLINEAR HYPERBOLIC SYSTEMS c64
Alain Lerat and Roger Peyret *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 1-38 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 61-79 (For availability see N76-21123 11-99)

The construction and study of a general class of three-point predictor-corrector explicit schemes, accurate to the second order, for the solution of hyperbolic systems is described. These schemes are shown to depend on two parameters; a system approximating them with third-order accuracy (an equivalent system) was derived. A nonlinear analysis of the equivalent system was performed in order to compare the dispersive and dissipative properties of the two-parameter schemes and to explain the existence of the parasitic oscillations which often appear in the numerical solutions. An optimal two-parameter was found. The dissipative effect of an artificial viscosity was also considered. Finally, these results were applied to gas dynamics for the case of the flow in a shock tube. Author (ESA)

N76-21125 European Space Agency, Paris (France).
ON THE FLOW AROUND AN AIR INLET **c02**
Henri Werle and Marc Gallon *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 39-60 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 81-92 (For availability see N76-21123 11-99)

A hydraulic test tunnel study was conducted to determine the external and internal flow separations capable of affecting the performance of air inlets. The results obtained are essentially qualitative, but they draw attention to certain pitfalls common in flow experiment procedures. For each intake geometry, the flow configuration, influence of geometric and aerodynamic parameters, and efficiency of the various means implemented to avoid or minimize separations were ascertained. Author (ESA)

N76-21126 European Space Agency, Paris (France).
OUTLINE OF A THEORY OF METAL PLASTIC FATIGUE BASED ON THE PROBABILITY OF INTRUSION FORMATION **c39**
Georges Vidal *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 61-83 refs Transl. into ENGLISH from La Recherche Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 93-104 (For availability see N76-21123 11-99)

The fatigue phenomenon has previously been shown to be first localized at the metal surface and, more precisely, to have its origin in the superficial formation of intrusions. Now, several types of intrusion, namely single, double, triple, etc., are defined. The proposed theory supposes S planes of alternate shears and determines the formation probability of an intrusion whose depth is at least equal to a given value E. Calculation of this probability is carried out not only for a given plane, but also for all the S shear planes. The initiation of fatigue fracture is assumed to happen when one intrusion of critical depth appears on at least one of the shear planes. The agreement of the results of this theory with experimental data is good, as it is possible to deduce from it, theoretically, the Coffin and Manson experimental laws, which concern plastic low-cycle fatigue. Author (ESA)

N76-21127 European Space Agency, Paris (France).
CHARACTERIZATION OF THE SOUND FIELD OF A HOT JET FROM ITS INFRARED EMISSION **c71**
Jean-Francois DeBelleval *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 84-101 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no. 1975-2, Mar.-Apr. 1975 P 105-115 (For availability see N76-21123 11-99)

How the turbulence of a hot flow, whether subcritical or supercritical, can be characterized from its own infrared emission is shown. After a description of the measurement, calibration and signal processing techniques, some examples of application are discussed. The use of existing theoretical models permits an acoustic interpretation of the measurements, after a numerical treatment of the results; this is compared with far-field acoustic measurements, carried out in an anechoic chamber and is also discussed through correlations between the flow and the near and far sound field. Author (ESA)

N76-21128 European Space Agency, Paris (France).
COMPUTATION OF THE NATURAL MODES AND FREQUENCIES OF A RIGID TANK OF ARBITRARY SHAPE PARTIALLY FILLED WITH WATER **c34**
Rabah Tahraoui *In its* La Rech. Aerospatiale, Bi-monthly Bull. No. 1975-2 (ESA-TT-205) Nov. 1975 p 102-118 refs Transl. into ENGLISH from La Rech. Aerospatiale, Bull. Bimestriel (Paris), no 1975-2, Mar.-Apr. 1975 p 117-126 (For availability see N76-21123 11-99)

A three-dimensional finite element method was used to transform the rigid-shell natural mode-frequency problem into an eigenvalue treatment of a linear operator in finite-dimensional space. Two fluid finite elements are defined: a parallelepiped element and an isoparametric-type hexahedron element. Theoretical results of applying these parameters to the analysis of parallelepipedal and cylindrical tanks are presented and compared with analytical results from the literature. The work is relevant to the vibration of aircraft fuel pods and to the design of tankers. Author (ESA)

N76-21129# Bundesministerium der Verteidigung, Bonn (West Germany).
CONTRIBUTIONS TO BALLISTICS AND DETONATION PHYSICS [BEITRAEGE ZUR BALLISTIK UND DETONATIONSPHYSIK]
DOKZENTBW 1975 277 p refs Partly in GERMAN; partly in ENGLISH; partly in FRENCH
(BMVg-FBWT-75-13) Avail: NTIS HC $9.25; DOKZENTBW DM 78,00

Papers in the fields of terminal ballistics, detonation physics, and shock waves are presented. Topics include: projectile stability, multiplate armors, dynamic compression of bar-shaped projectiles, effects of natural and preformed fragments, underwater submersion, underwater detonation with multiple charges, penetration and power dissipation of shaped charges, detonating explosive tubes, spall effects, shock wave propagation in branched ducts and rocks, nuclear explosion simulation, shock wave effects in minerals, and high speed photography. For individual titles, see N76-21130 through N76-21149.

N76-21130 Institut Franco-Allemand de Recherches, St. Louis (France).
GYROSCOPIC STABILITY FACTOR OF PROJECTILES WITH NONLINEAR MOMENTS **c02**
H. Molitz *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 9-27 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

In order to determine stability conditions in ballistics, the equations of projectile motion are partially linearized. The classical stability condition requires the so-called gyroscopic stability factor to be greater than one. According to the respective stability requirements, the theory of the spinning top gives the same stability limit. For projectiles, however, the momentum of aerodynamic forces can be a more complicated function of the angle of yaw. For some possible momentum curves of this type, zero value diagrams are established allowing determination of the maximum angle of yaw to be expected. In order to illustrate the motion itself, some examples are numerically computed.
Author (ESA)

N76-21131 Ernst-Mach-Inst., Freiburg (West Germany).
TERMINAL BALLISTIC STUDIES OF THE EFFECTIVENESS OF MULTIPLE PLATE TARGETS AT HIGH IMPACT VELOCITIES **c39**
V. Hohler, H. Reichenbach, and A. Stilp *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 29-41 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The mainly complex physical processes of penetration and perforation in multiple sheet plates are explained and the reasons for the improved protective effect as compared to single plates are discussed. In particular, the influence of the spacing of the plates is indicated by means of some examples. Usually, multiple spaced sheet plates have a better protective effect against the penetration and perforation of projectiles than single sheet plates at the same density area. Author (ESA)

N76-21132 Institut Franco-Allemand de Recherches, St. Louis (France).
DYNAMIC COMPRESSION TESTS WITH COPPER AND ALUMINUM CYLINDERS **c26**
G. Weihrauch *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 43-56 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

A method is described to determine the dynamic yield point of pure copper and 2024 T4-aluminum cylinders up to strain rates of 10,000/s. Using short-time photography, the stopping effect of the cylinders is measured while striking a rigid steel-plate in perpendicular direction with velocities between 50 and 200 m/s. Effects of shock wave reflection, heating, and work hardening were not taken into account. Both materials tested showed a dependency of a yield stress on the deformation velocity. For copper up to a strain rate of 4x1,000/s in first approximation a linear increase of the yield strength of 9 N/sq mm per 100/s was found, whereas for the 2024-aluminum-alloy the linear region extended up to a deformation velocity of 6x1,000/s with an increase of 8 N/sq mm per 100/s. The measured yield stress of copper was found to be 2.85 times as large as the (assumed)

static value of 200 N/sq mm. For 2024-aluminum, the dynamic yield stress lies about 2.75 times above the static value of 340 N/sq mm. Author (ESA)

N76-21133 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).

EFFECT OF SHAPE AND STRENGTH OF MODEL FRAGMENTS ON THEIR EFFECTIVENESS **c39**

H. Senf *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 57-64 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The penetration depth of model fragments was investigated. The fragments used were steel and tungsten carbide spheres and cylinders, and the targets were thick AlCuMg 1 F40 and steel plates. It is shown that the penetration depth is a function of the fragment's terminal velocity, density, tensile strength, hardness, and shape. An increase of these parameters generally results in an increase of penetration depth. ESA

N76-21134 Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (West Germany).

CUMULATIVE FRAGMENT EFFECTS **c39**

M. Held *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 65-85 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The cumulative effects of fragments hitting a target within short time intervals of each other, is considered. The different cumulative phenomena in solid, liquid, and gaseous media are defined. In particular, the different types of reaction which occur during cumulative blast effects are discussed. First results are presented of tests showing the cumulative blast effects after the penetration of target plates by fragments. Author (ESA)

N76-21135 Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (West Germany).

MEASUREMENT OF THE SPATIAL DISTRIBUTION AND THE VELOCITY DISTRIBUTION OF FRAGMENT CLOUDS AND SHOT GRAINS **c35**

M. Held and P. Nikowitsch *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 87-117 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The measuring technique presented uses argon flash lamps, which allows photography of fragments as self-shining points with a simple polaroid-camera. This method provides the important data of fragment or grain ammunition in acceptance tests in spite of the small size of the fragments, e.g. only 2.4 mm diameter, immediately after the test. The method is compared to shadow and X-ray flash photography. Author (ESA)

N76-21136 Metallwerk Elisenhuette G.m.b.H., Nassau (West Germany).

EMPIRICAL CALCULATION OF BUBBLES OF SUBMERGING BODIES OF REVOLUTION **c34**

R. F. Steffen *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 119-128 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

A computation method is given which, on the basis of Reichardt's rule of cavitation bubbles, makes it possible to determine, roughly, the bubbles generated during the immersion of bodies of revolution. The immersion bubbles of pellets were computed and compared to experimental values found in references. An adequate agreement between measured and computed immersion bubbles may be obtained for an empirically determined characteristic value in many cases. Author (ESA)

N76-21137 Institut Franco-Allemand de Recherches, St. Louis (France).

THE EARLY HISTORY OF SHAPED CHARGES WITH FLAT CONES

G. Thomer *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 129-139 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

Early research work undertaken on explosive driven projectiles is reviewed, and a survey is given of investigations performed at the LRBA, Saint-Louis, predecessor of ISL, between 1945 and 1950. ESA

N76-21138 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).

FRAGMENTS PROJECTED BY HIGH EXPLOSIVES **c39**

U. Hornemann *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 141-147 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

Mass and configuration play an important role in the effectiveness of high explosive charges. Two types of charges, covered with prefragmentated or homogeneous shells, were compared on the basis of the mass relation factor. Rates of assessment are described and discussed for the terminal ballistic behavior of preformed and natural fragments upon thin multiple sheets of aluminum and steel. The penetration performance of powder gun accelerated steel spheres was compared to the performance of spheres accelerated by high explosives. Author (ESA)

N76-21139 Arbeitsgruppe fuer Physik der Hochdruckplasmen und Impulsentladungen, Erkrath (West Germany).

PENETRATION OF SHAPED CHARGE JETS IN STEEL TARGETS WITH TENSILE STRENGTHS BETWEEN 30 AND 300 kp/sq mm **c39**

K. Hollenberg *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 149-158 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The penetration capacity of cylindrical shaped charges (caliber 48mm, inserted copper cone with 60 deg apex angle) was determined for 3mm thick steel plates of different tensile strengths (30, 45, 71, 205 and 290 kp/sq mm). The penetration time function was measured using an electrical method. Results show reduction of penetration depth (by factor 3) and volume of the penetration channel (by factor 4) for increasing tensile strength (by factor 10). Reduction of the penetration capacity is caused by a reduction in channel diameter for increasing tensile strength of the target material. ESA

N76-21140 Studiengruppe Ballistik Schrobenhausen (West Germany).

EFFECTIVENESS DISPERSION OF SHAPED CHARGES **c39**

F. R. Thomanek *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 159-172 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The dispersion of penetration efficiency of shaped charges due to geometrical inaccuracies, such as cracks and flaws in the explosive charge, were investigated. The effect of systematically introduced errors (slits in the charge, unsymmetric components) on spike formation was examined using X-ray flash photography. A quadratic distance law was derived to calculate spike perturbations by charge cracks and flaws. The temperature dependence of the penetration depth is shown to be based on these imperfections. ESA

N76-21141 Institut Franco-Allemand de Recherches, St. Louis (France).

RECORDING OF TRANSIENT PHENOMENA USING A STREAK CAMERA AND A HIGH-EXPLOSIVE DRIVEN FLASH **c35**

Y. DeLongueville *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 173-182 In FRENCH; ENGLISH summary (For availability see N76-21129 11-99)

A new method to take frame sequences of a transient event by means of a simple streak camera is described. The camera, without slit, records light pulses which are generated by a detonation shock in a series of very narrow argon chambers as used for taking shadowgraphs. Frame rates are of the order of 1 MHz and exposure times below 10 nsec. A series of pictures of a shaped charge jet after perforating a steel plate was made using this equipment. Author (ESA)

N76-21142 Studiengruppe Ballistik Schrobenhausen (West Germany).

THE FLOW IN A DETONATING EXPLOSIVE TUBE **c34**

E. H. Jager and F. R. Thomanek *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 183-194 refs In GERMAN; ENGLISH summary (For availability see

N76-21129 11-99)

The flow configuration produced by the axial detonation of a hollow cylindrical shaped charge was studied experimentally and theoretically. The detonation products in the bore were found to outrun the detonation and to produce a strong shock in the gas inside the bore. Changes in the adiabatic exponents of the shocked gas and of the detonation fumes were considered. Such explosive tubes can be used as shock tubes, for the acceleration of projectiles, for point initiation (in the case of very small bore), for MHD-power generation, etc., since the flow velocities under standard atmospheric conditions can exceed 12 km/sec.

Author (ESA)

N76-21143 Battelle Inst., Frankfurt am Main (West Germany).
EXPLOSIVE DRIVEN GAS COMPRESSION IN AN AXISYMMETRIC HARD-CORE DEVICE **c70**

W. Geiger and G. Honcia *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 195-206 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

A copper tube filled with an explosive, an axial conical copper plug (hard core), and a conical tube end piece form the device used to heat gases to high temperatures. In the case of axial detonation of the tube the heating of the gas contained therein takes place in three steps: by linear compression, by multiple reflection of shock waves, and by cubic compression at the end piece. The hard-core plug allows a doubling of the admissible tube bending angle and prevents axial instabilities. Gas temperatures obtained: over 50,000 K.

ESA

N76-21144 Metallwerk Elisenhuette G.m.b.H., Nassau (West Germany).
UNDERWATER DETONATION WITH MULTIPLE EXPLOSIVE CHARGES **c34**

H. G. Bugiel *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 207-214 In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The behavior of gas bubble systems generated by underwater detonations of multiple explosive charges was investigated in model tests using high-speed cinematography. A few examples are given to illustrate the behavior of these gas bubble systems subsequent to simultaneous or time delayed detonations of multiple charges. These investigations were aimed at making a better use of the energy contained in a given amount of high explosive by dividing it into several charges.

Author (ESA)

N76-21145 Battelle Inst., Frankfurt am Main (West Germany).
INVESTIGATIONS ON SPALL FRACTURE **c39**

H. U. Freund and W. Geiger *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 215-228 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

Experimental and theoretical investigations, performed to verify the relations between shock wave profile, dynamic tensile strength of the material, and thickness of the spalling layer are described. Plane shock waves are generated in an aluminum specimen by means of plane wave generators. The waves strike the free surface with normal or oblique incidence. By determining the velocity and pressure profile in the shock wave and the thickness of the spalling layer a detailed description of the spall conditions is achieved also for spall inhibiting boreholes at the free surface.

Author (ESA)

N76-21146 Ernst-Mach-Inst., Freiburg (West Germany).
SHOCK WAVE PROPAGATION THROUGH BRANCHED DUCTS **c34**

W. Heilig and H. Reichenbach *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 229-239 refs In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

The propagation of shock waves through four different models of branched ducts was investigated by shock tube experiments and theoretically. Shadowgraphs made by a Cranz-Schardin multiple spark camera for primary shocks with overpressure in the range of 0 bar to 9 bar provide the gas-dynamical understanding of the process and, additionally, by a velocity measurement, the intensities of the smoothed out shocks in the ducts. Using a helium driven shock tube, pressure measurements were performed in the same models at places five channel diameters before and behind the junction for primary shocks up to 40 bar overpressure. An approximate theory developed independently from experiments is based on Whitham's theory and on the law of conservation of energy. The cases of primary shocks with subsonic as well as with supersonic afterflow are taken into account and the measurements are confirmed.

Author (ESA)

N76-21147 Battelle Inst., Frankfurt am Main (West Germany).
SIMULATION OF THE NUCLEAR EXPLOSION LOADING OF BURIED SHELTERS **c39**

P. Corvin, K. Metz, F. Rischbieter, and E. Schaepermeier *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 241-249 ref In GERMAN; ENGLISH summary (For availability see N76-21129 11-99)

Model tests in shock wave simulators and computation methods are described used for estimating the loads and buried shelters resulting from nuclear blast-induced ground shock waves. The pressure simulator Drusiwal, consisting of 800 compressed air driven water tubes for production of defined earth shocks, is described. Applications of a computer program for calculating pressure fields in the ground are discussed. The mathematical model used is explained.

ESA

N76-21148 Tubingen Univ. (West Germany).
QUANTITATIVE MEASUREMENTS OF SHOCK LOADED MINERALS **c76**

J. Arndt, U. Hornemann (Arbeitsgruppe fuer Ballistische Forsch.), W. F. Mueller (Frankfurt Univ.), H. Schneider (Karlsruhe Univ.), and D. Stoeffler (Muenster Univ.) *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 251-273 refs In GERMAN; ENGLISH summary Sponsored in part by Deut. Forschungsgemeinschaft (For availability see N76-21129 11-99)

The irreversible changes occurring in minerals as a result of shock loading were examined. These effects were analyzed in the pressure range from 100 to 600 mbar. Tests carried out were: inclusion of the sample in a block of steel, shock wave generation by detonation of an explosive charge, and determination of the shock wave pressure in the sample. Shock wave deformed minerals were investigated by means of X-ray structure analysis, infrared spectroscopy, determination of refractivity, and other methods.

ESA

N76-21149 Technical Univ. of Norway, Trondheim. Inst. of Mechanics.
ON THE POSSIBILITY OF APPLYING A THEORETICAL APPROACH TO PROBLEMS IN ROCK DYNAMICS **c42**

L. N. Persen *In* Bundesmin. der Verteidigung Contrib. to Ballistics and Detonation Phys. 1975 p 275-288 refs (For availability see N76-21129 11-99)

(Contract F44620-75-C-0029)

An analytical approach whereby mainly applications to problems arising from stress waves in rocks caused by explosions have been envisaged is surveyed. The approach is thought to give an insight into such problems as wave propagation in rocks, the interaction between the explosive and the rock, the influence of different types of explosive, cratering, the interrelation between confined explosions and surface bursts, the interaction between the shock wave and a tunnel, etc. No detailed information on the analytic procedure is given, but attempts are made to stress the physical aspects of the approach and to give the importance of the parameters of the approach.

Author (ESA)

N76-21150# European Space Agency, Paris (France).
SPACE DEVELOPMENTS. EUROPE OR HOW THE OCTOPUS LEARNED TO DANCE

Roy Gibson 1974 5 p Presented at the World Aerospace Conf., San Francisco, 15-17 Oct. 1974

Avail: NTIS HC $3.50

Remarks are made about the changeover from ESRO and ELDO to the European Space Agency (ESA). Structural changes are outlined, and policy towards contractors is described. Cooperation with NASA is mentioned.

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